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Rios, III et al.

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(45) **Date of Patent: Apr. 21, 2015**

(54) **POSITIVE RETRACTION LATCH LOCKING DOG FOR A ROTATING CONTROL DEVICE**

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(22) Filed: **Jul. 15, 2011**

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(51) **Int. Cl.**
E05C 1/12 (2006.01)
E21B 33/08 (2006.01)
E21B 33/038 (2006.01)

(52) **U.S. Cl.**
CPC ***E21B 33/085*** (2013.01); ***E21B 33/038*** (2013.01)

(58) **Field of Classification Search**
USPC 166/338–345, 350, 368, 381
See application file for complete search history.

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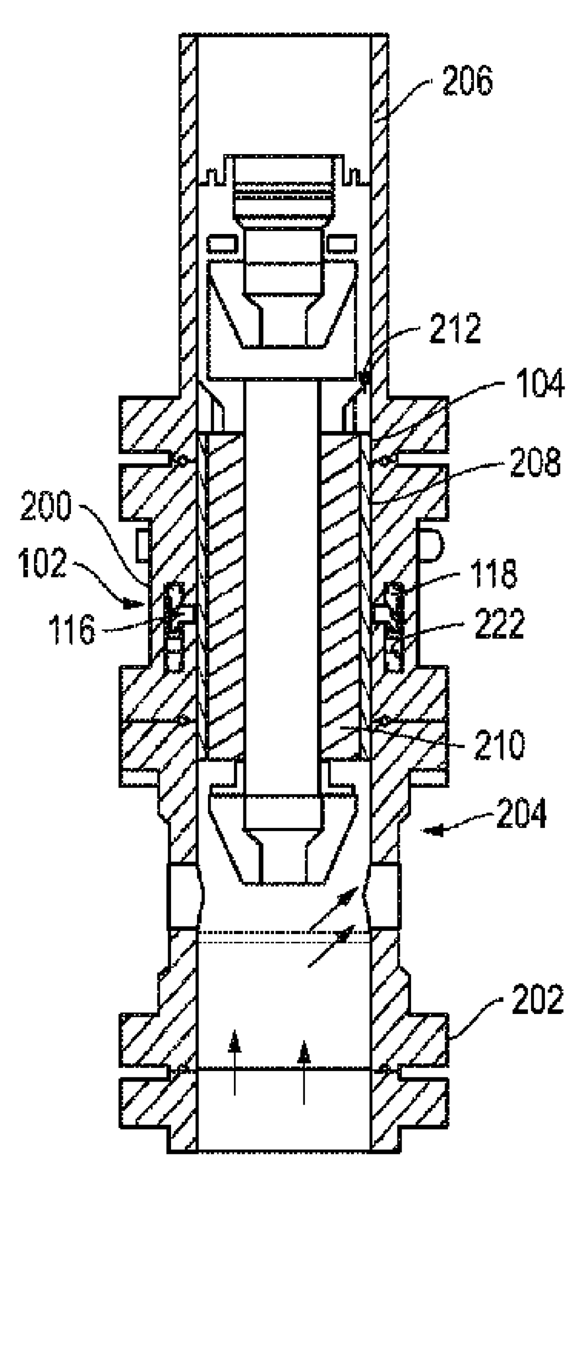
Primary Examiner — James G Sayre

(74) *Attorney, Agent, or Firm* — Mark A. Oathout; Oathout Law Firm

(57) **ABSTRACT**

A latch and method for use is provided for latching an item of oilfield equipment. The latch has a housing containing a latch member, and the latch member is movable between a radially engaged position in which it is engaged with the item of oilfield equipment, and a radially retracted position in which it is disengaged from the item of oilfield equipment. An actuator is configured to drive the latch member into the radially engaged position. Further, the actuator is configured to drive the latch member toward the radially retracted position.

33 Claims, 21 Drawing Sheets



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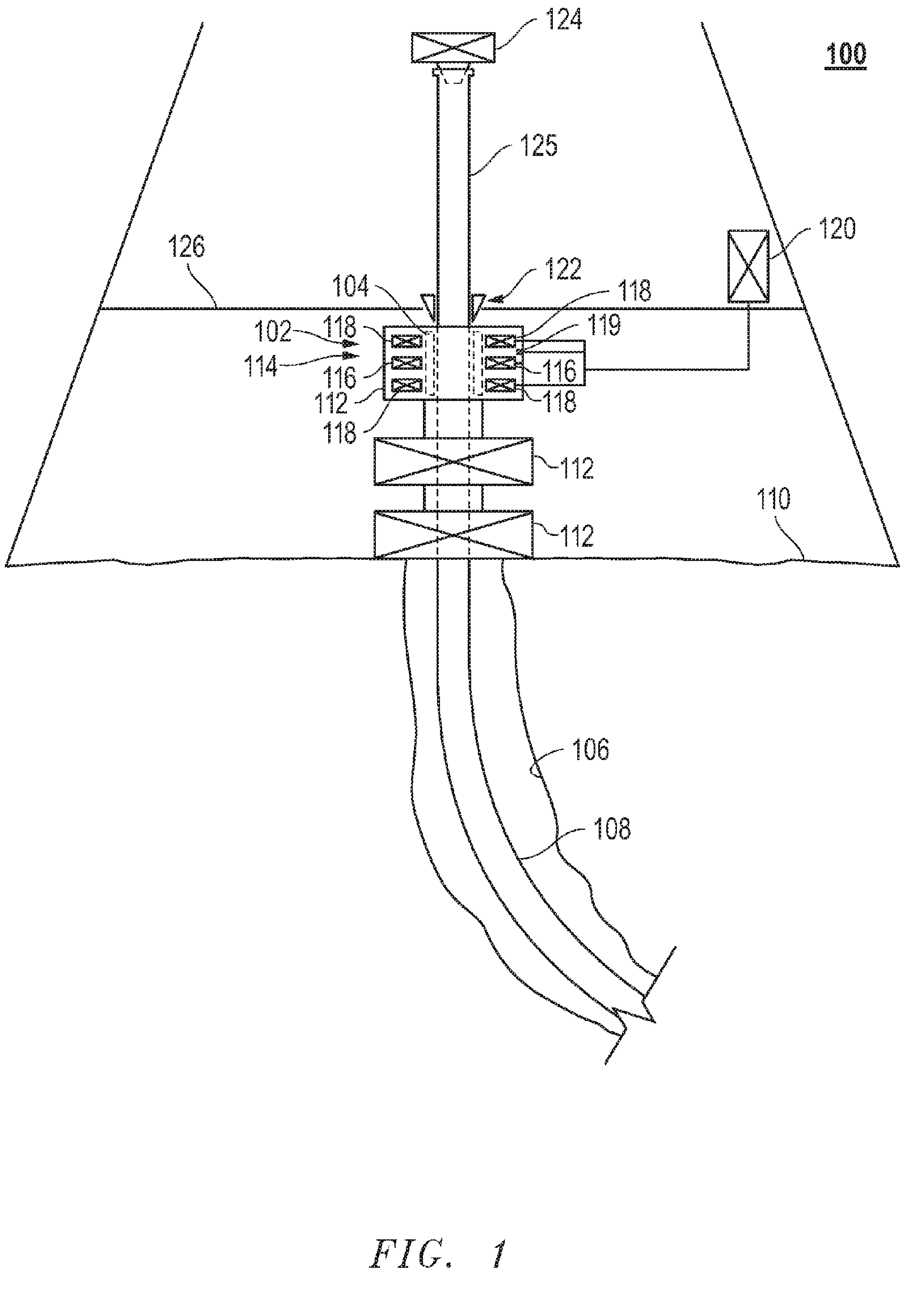
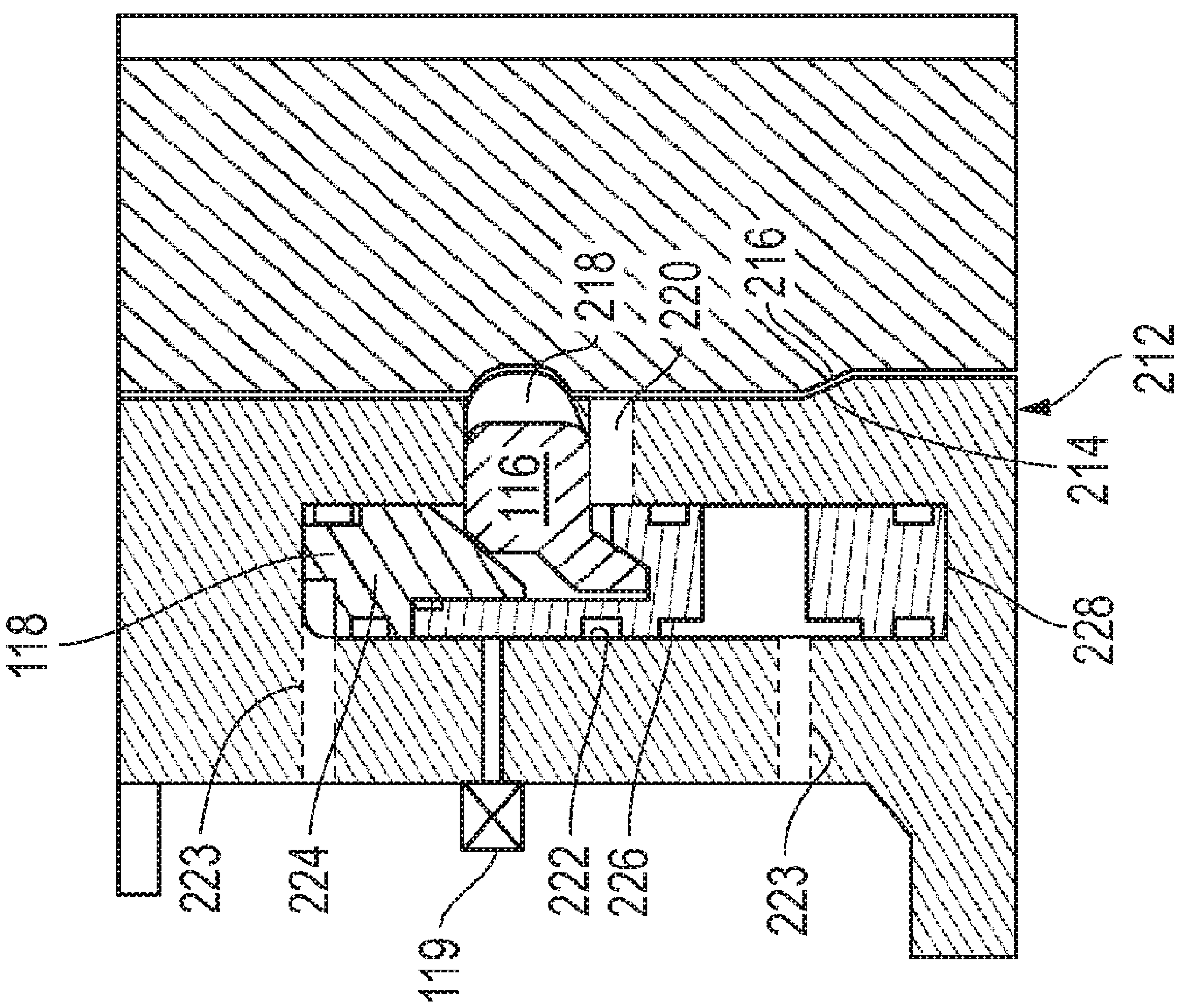


124
100
125
120
126
122
104
118
102
118
119
114
116
116
112
118
118
112
110
112
106
108

FIG. 1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226
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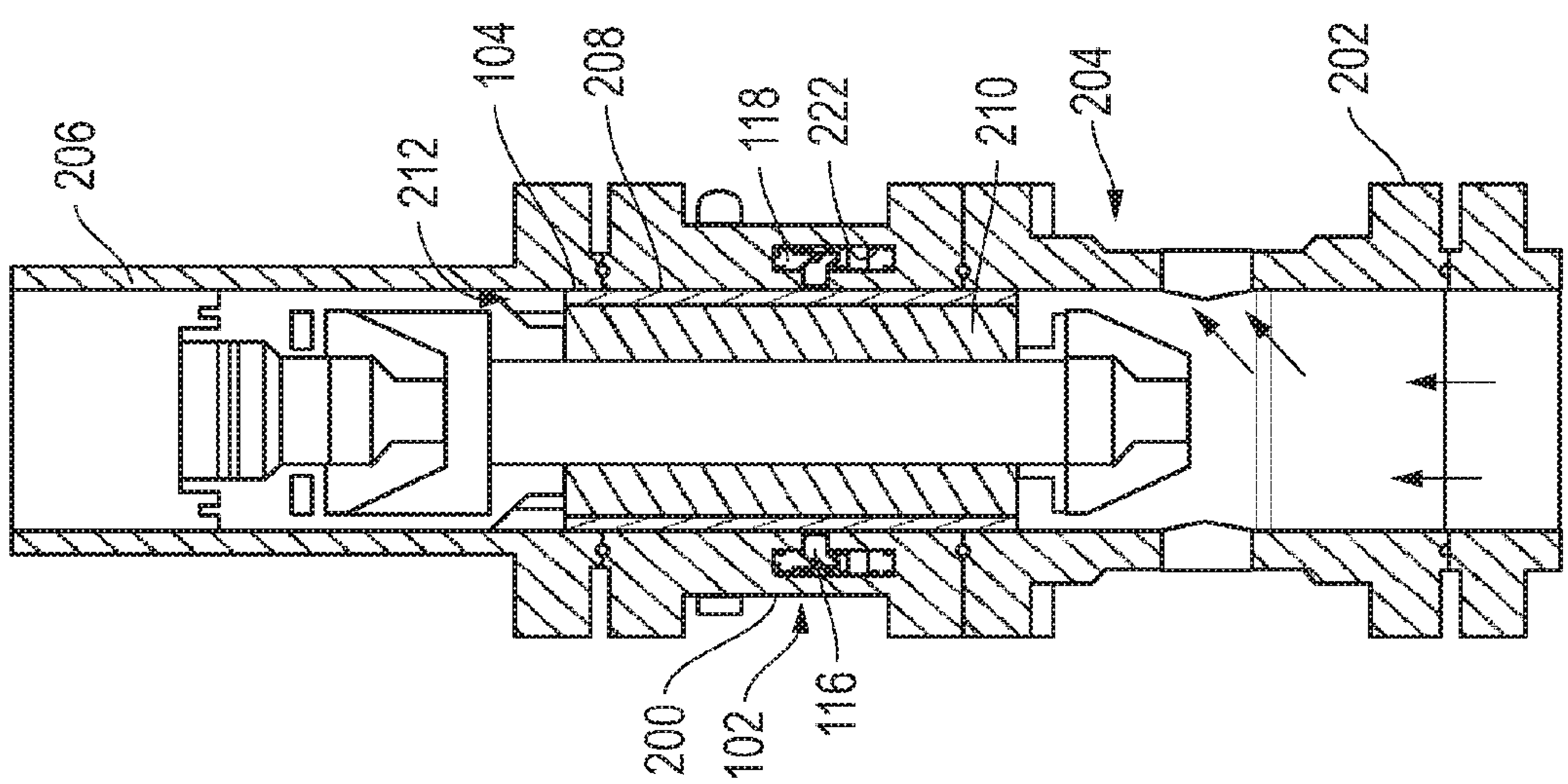
FIG. 2B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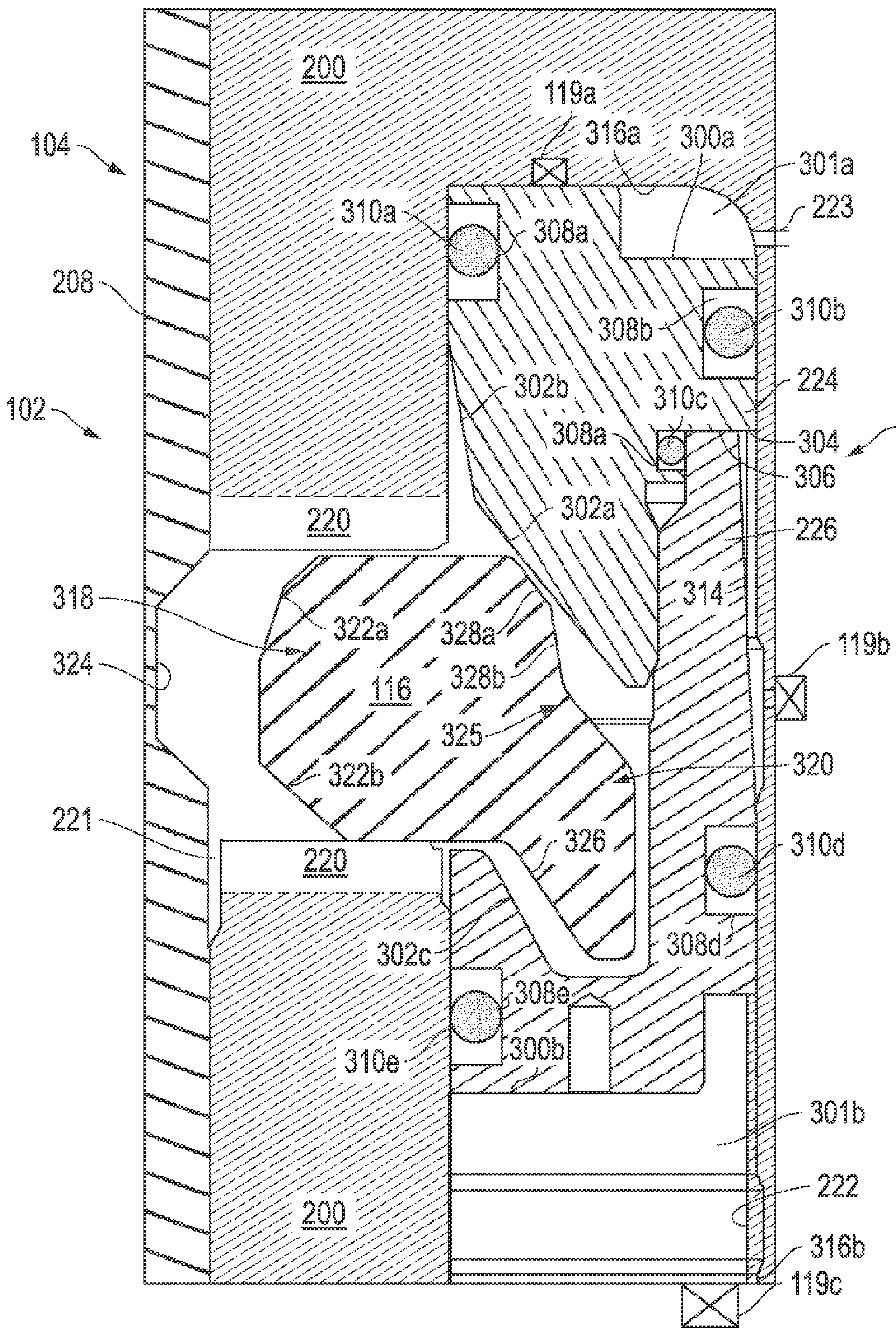
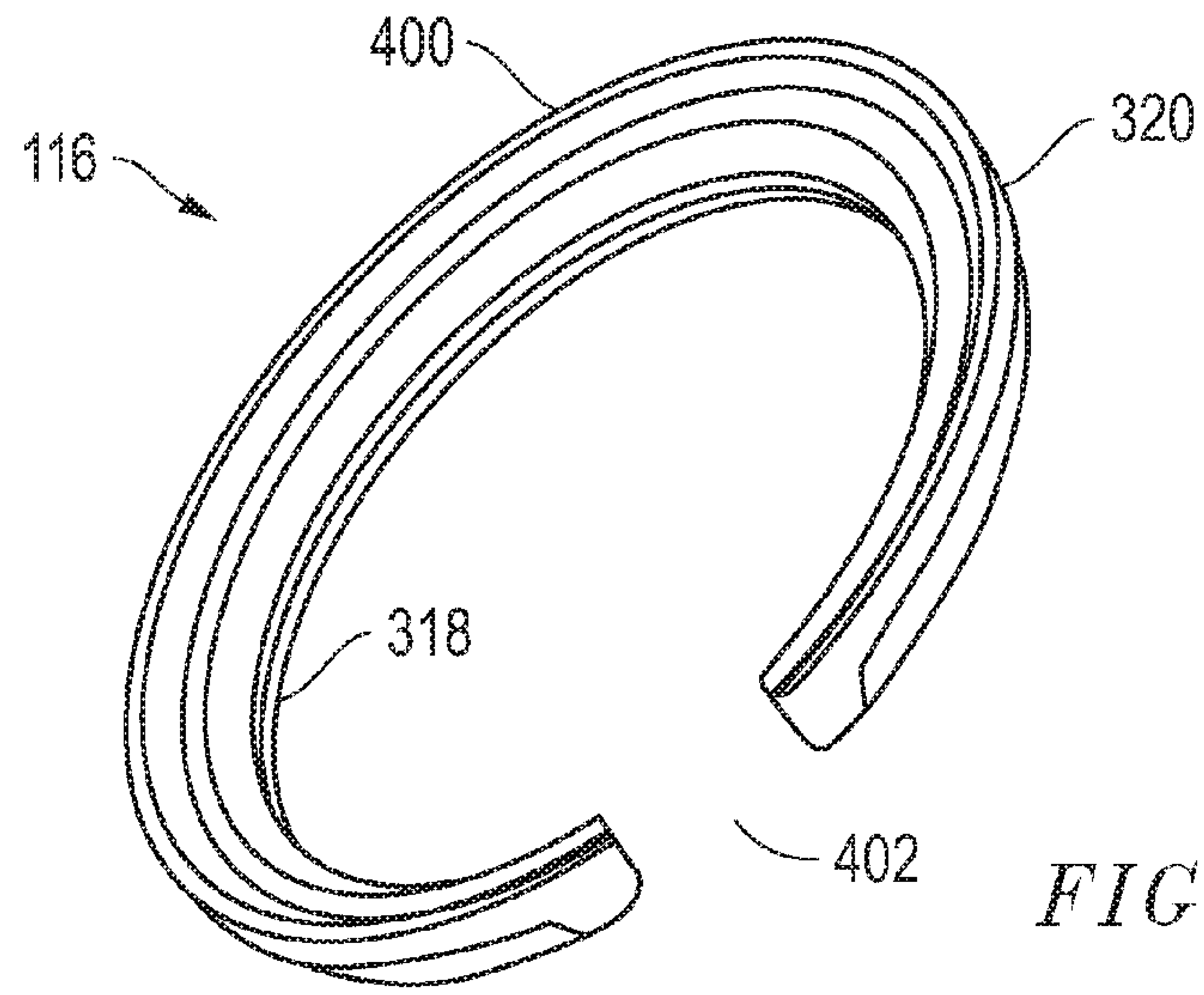
212
104
208
118
222
210
204
202
200
102
116

FIG. 2A



200
119a
316a
300a
301a
104
310a
308a
223
208
308b
310b
302b
310c
224
102
308a
304
312
306
220
302a
226
318
322a
328a
314
324
116
328b
119b
325
322b
320
221
220
326
310d
302c
308d
308e
310e
300b
301b
222
200
316b
119c

FIG. 3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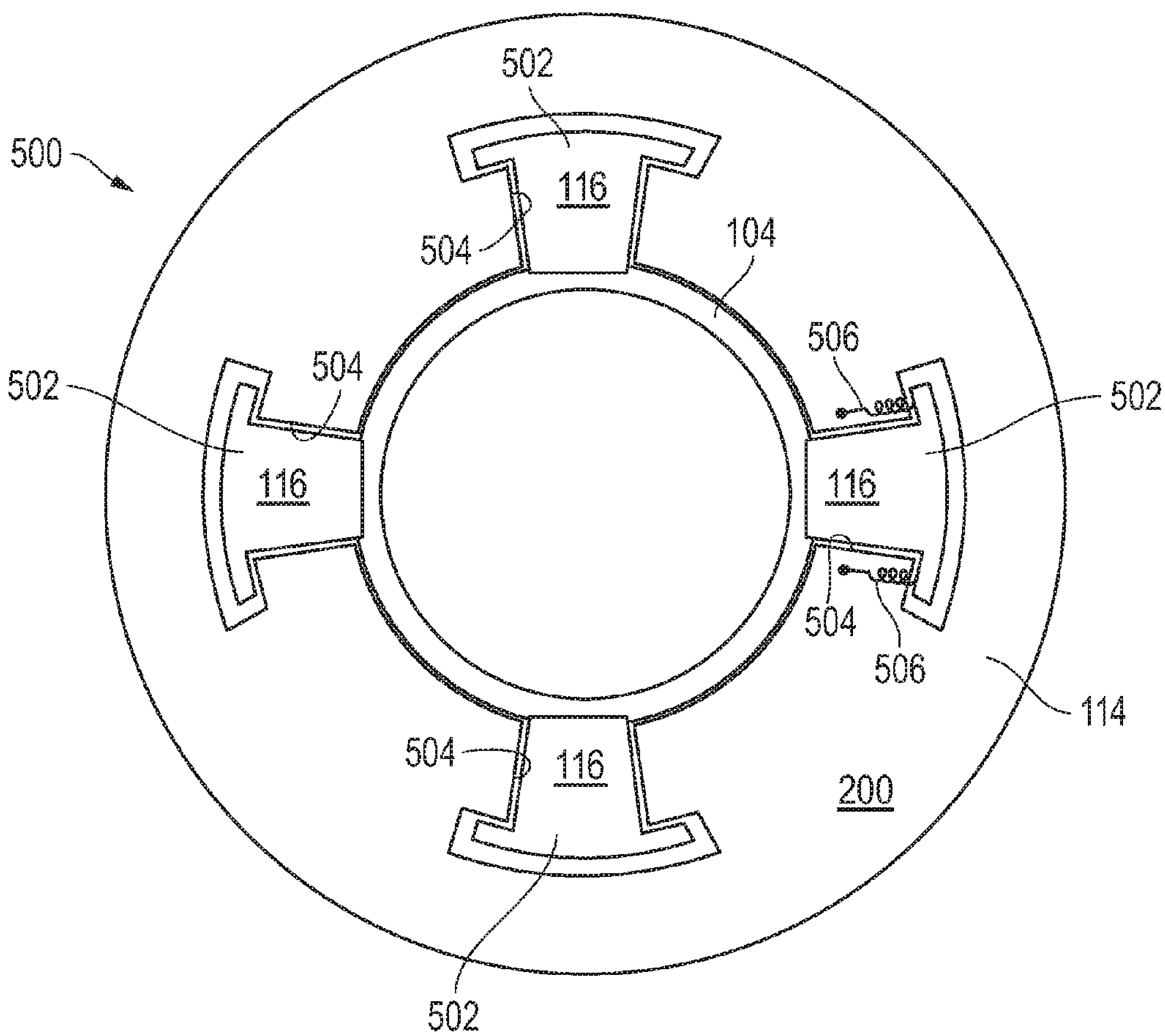
116
320
318
402

FIG. 4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500
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104
506
502
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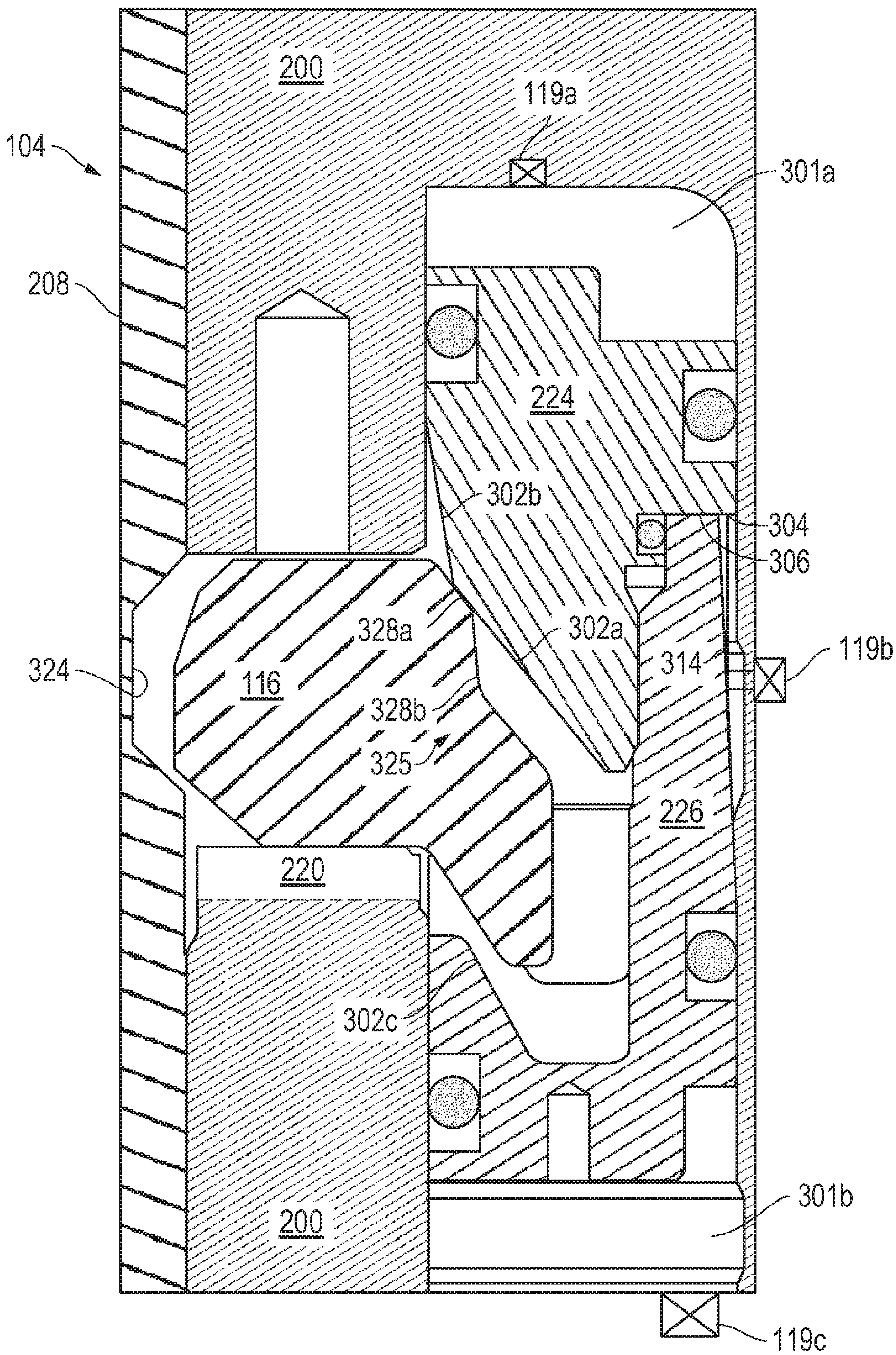
502
116
116
504
506
114
504
116
200
502

FIG. 5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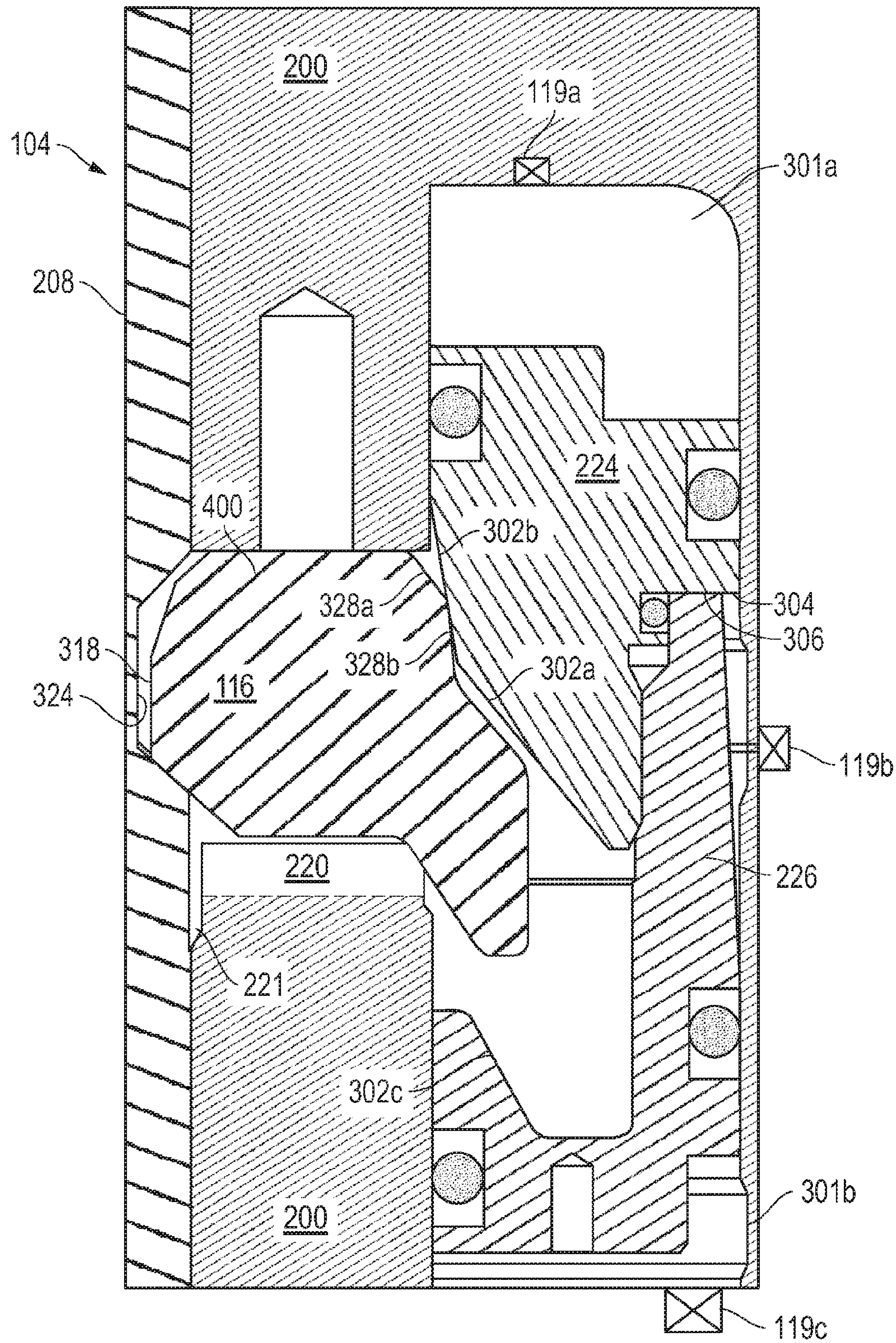
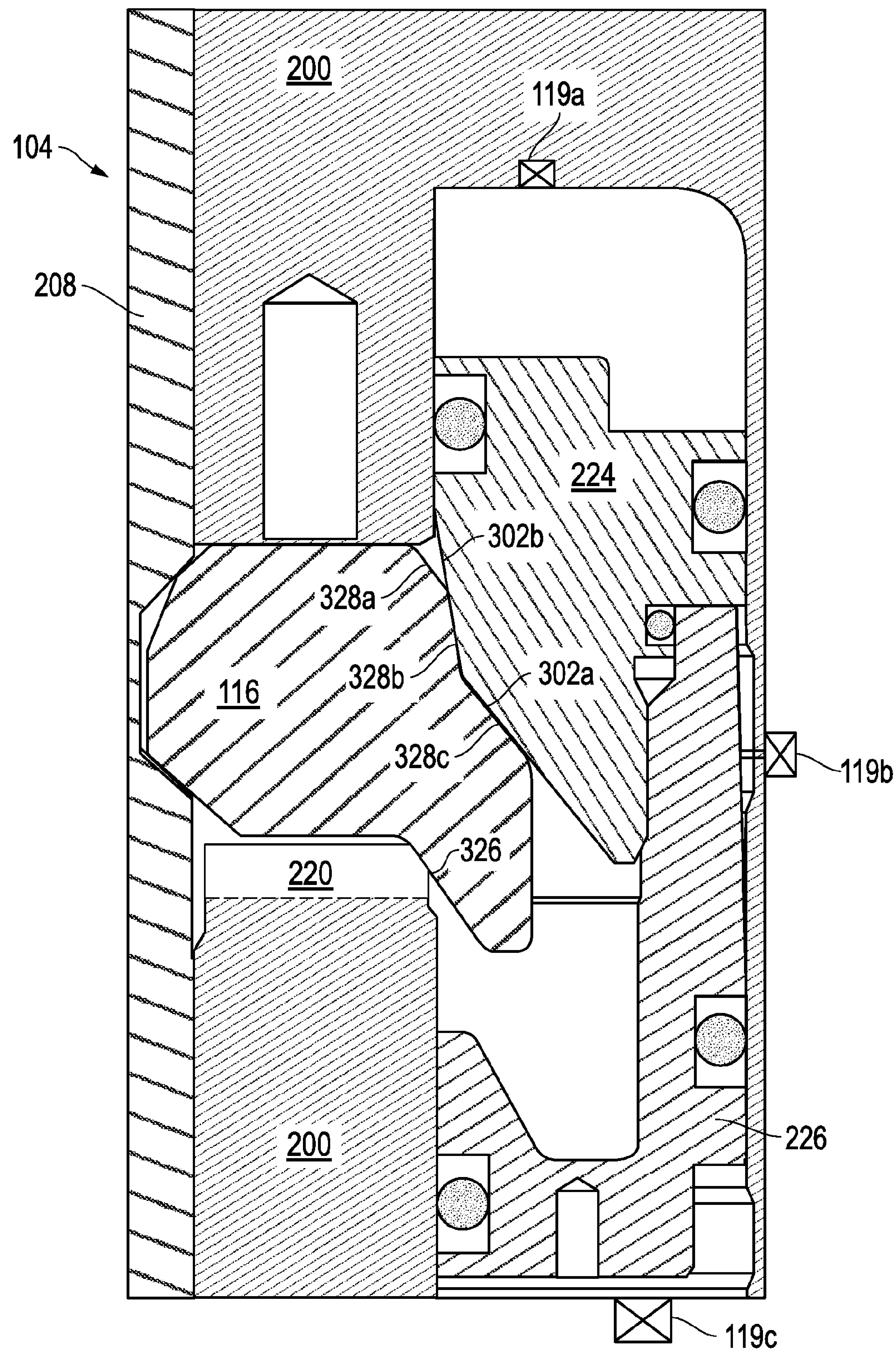
119a
104
301a
208
224
302b
304
306
328a
302a
324
116
314
119b
328b
325
226
220
302c
200
301b
119c

FIG. 6



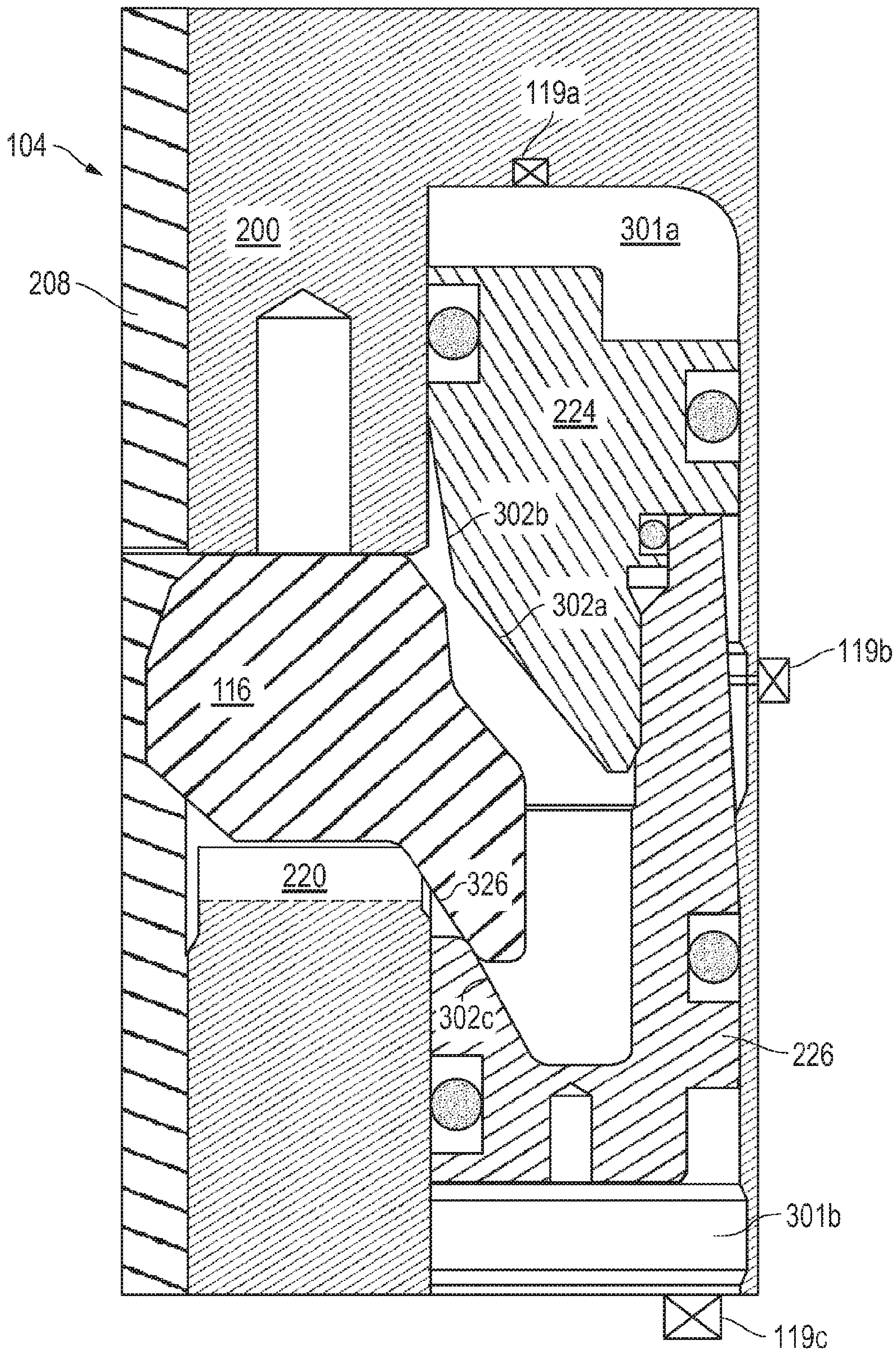
200
119a
104
301a
208
224
400
302b
328a
304
306
318
328b
302a
324
116
119b
220
226
221
302c
200
301b
119c

FIG. 7



200
119a
104
208
224
302b
328a
116
328b
302a
328c
119b
326
220
200
226
119c

FIG. 8



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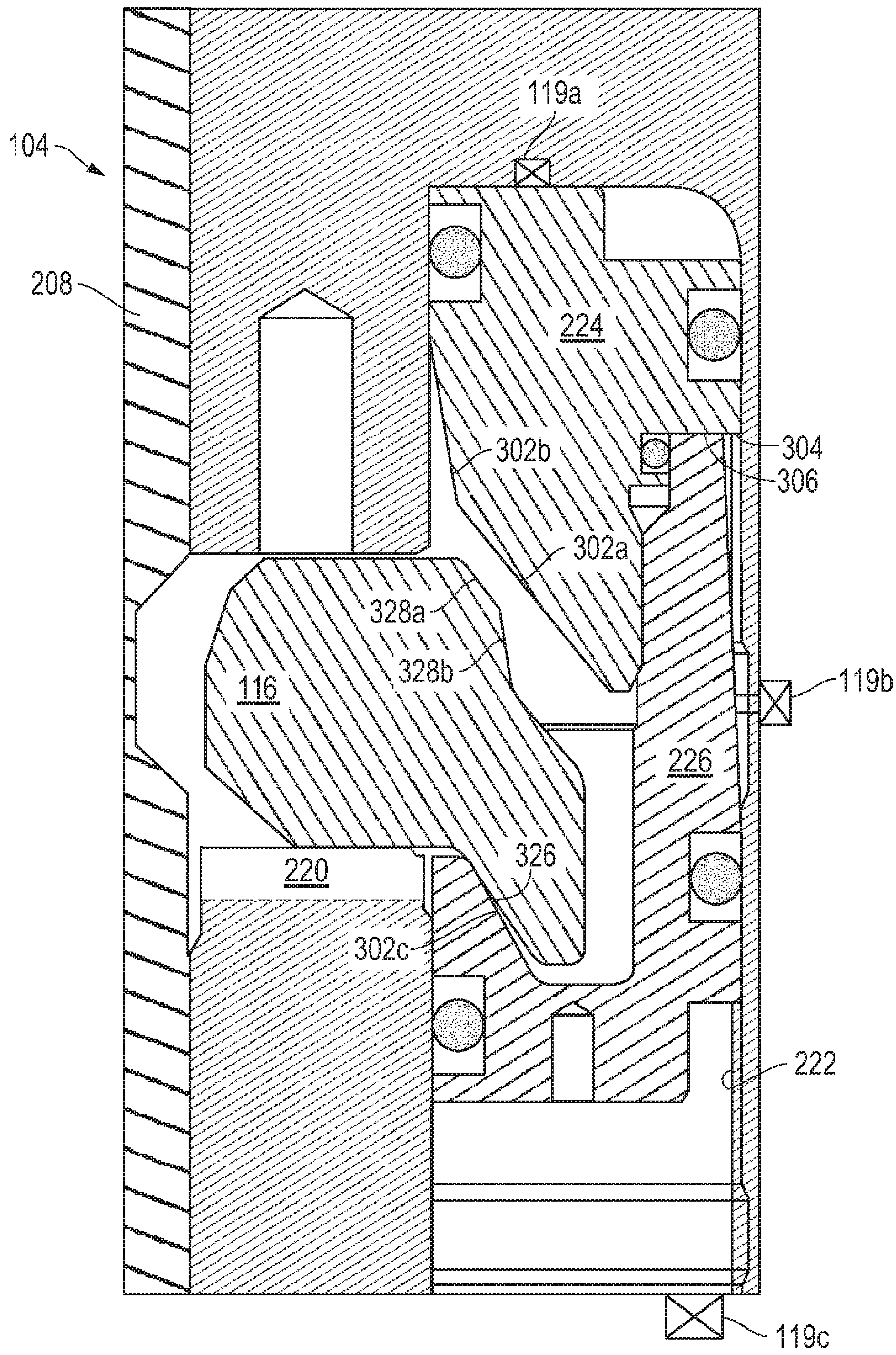
119a
200
301a
208
224
302b
302a
119b
116
220
326
302c
226
301b
119c

FIG. 9



104
119a
208
224
304
302b
306
302a
328a
328b
116
119b
226
220
326
302c
222
119c

FIG. 10

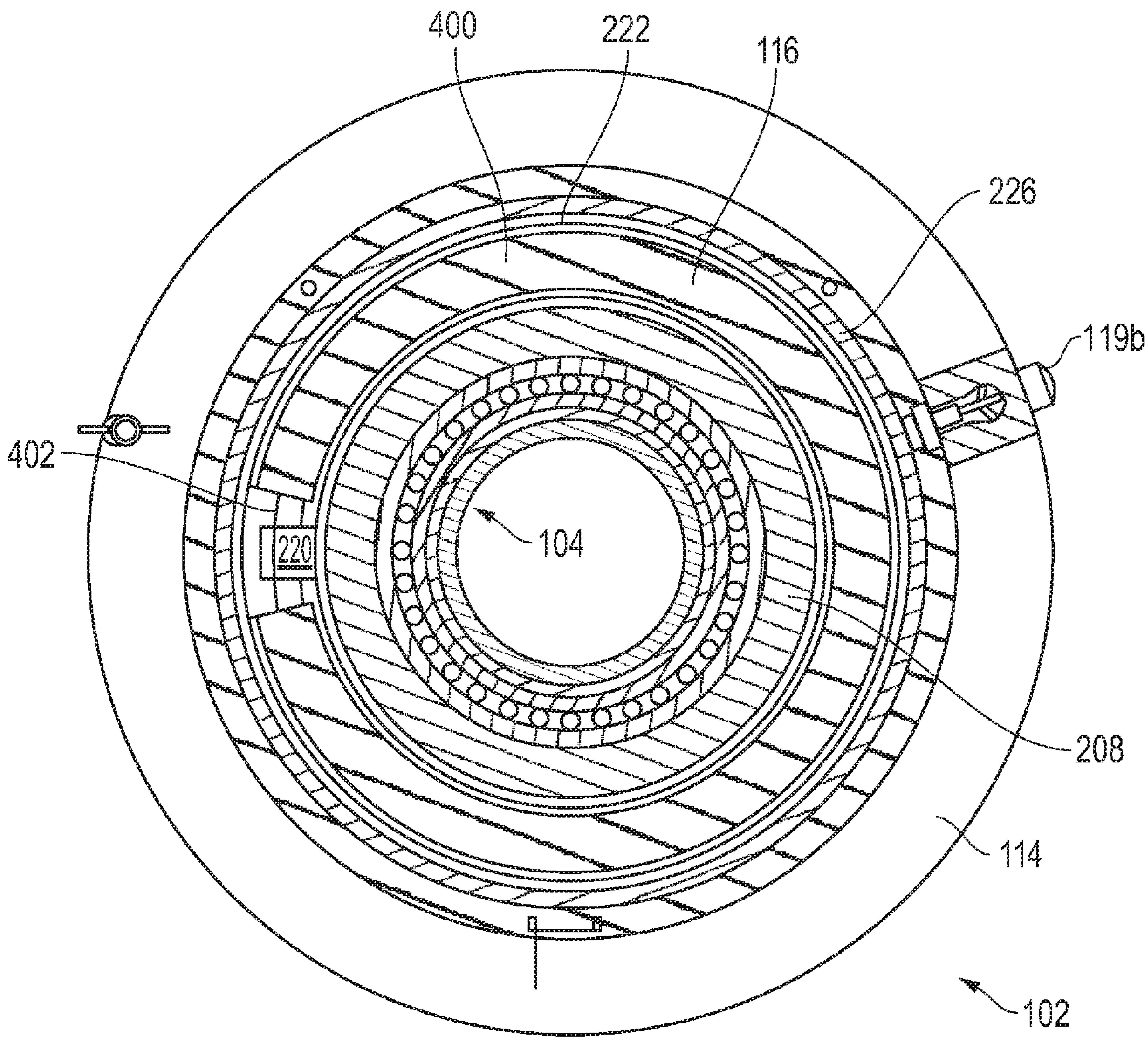


FIG. 11

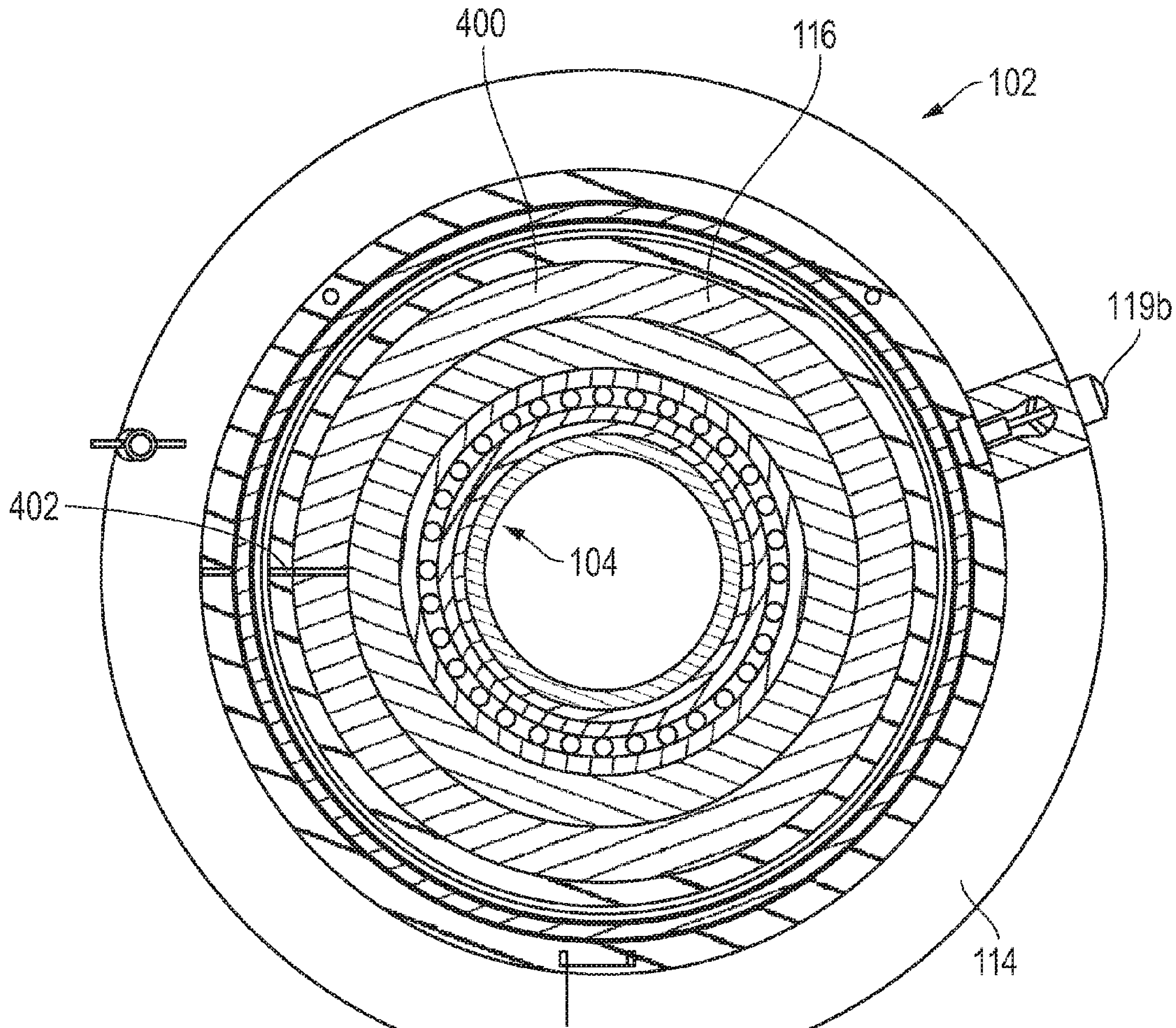


FIG. 12

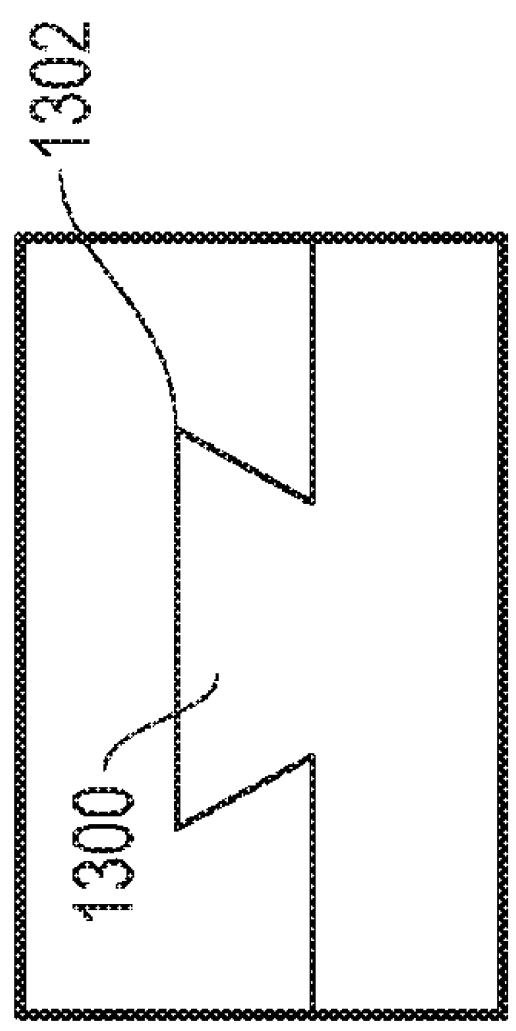


FIG. 13B

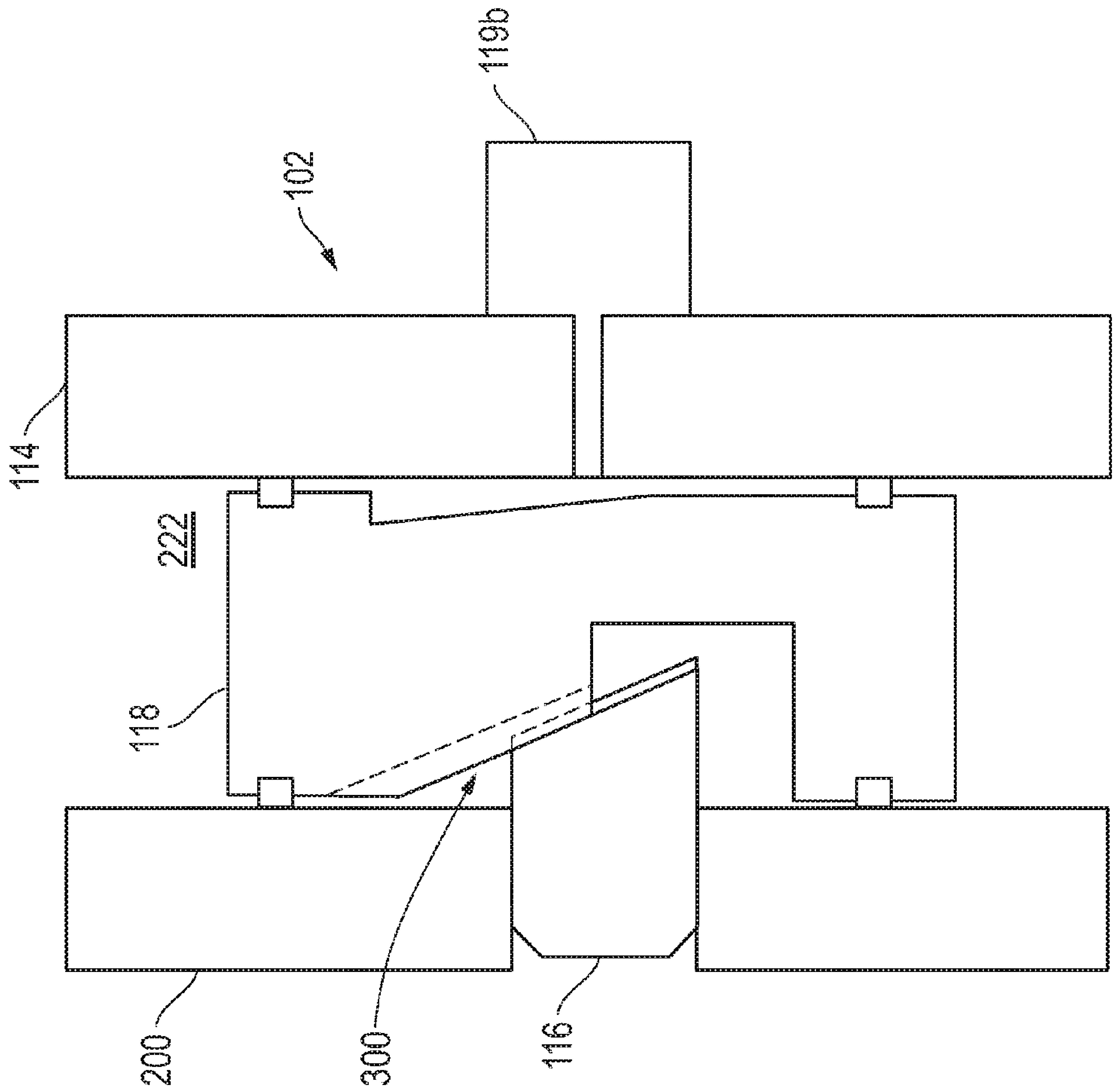


FIG. 13A

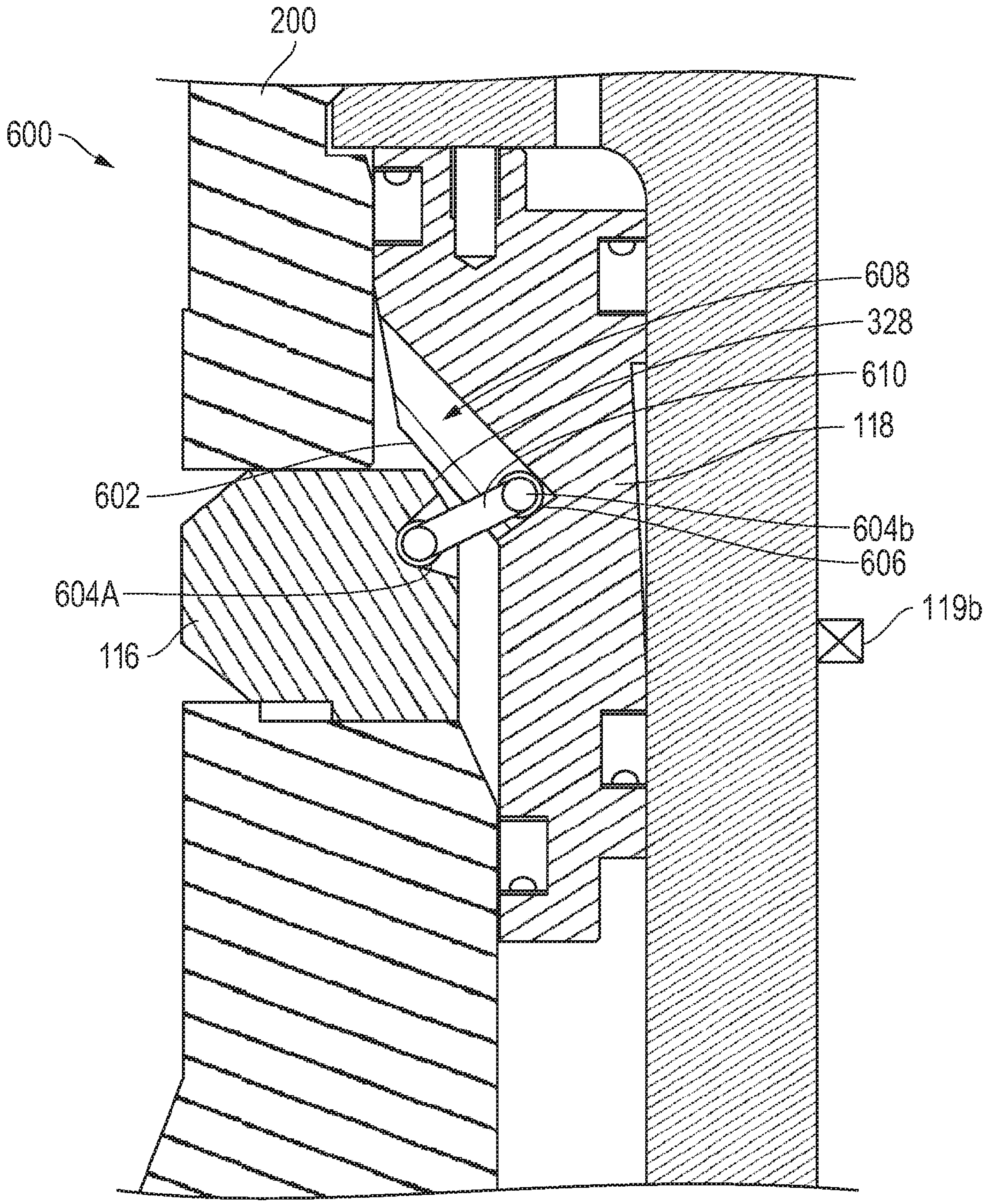
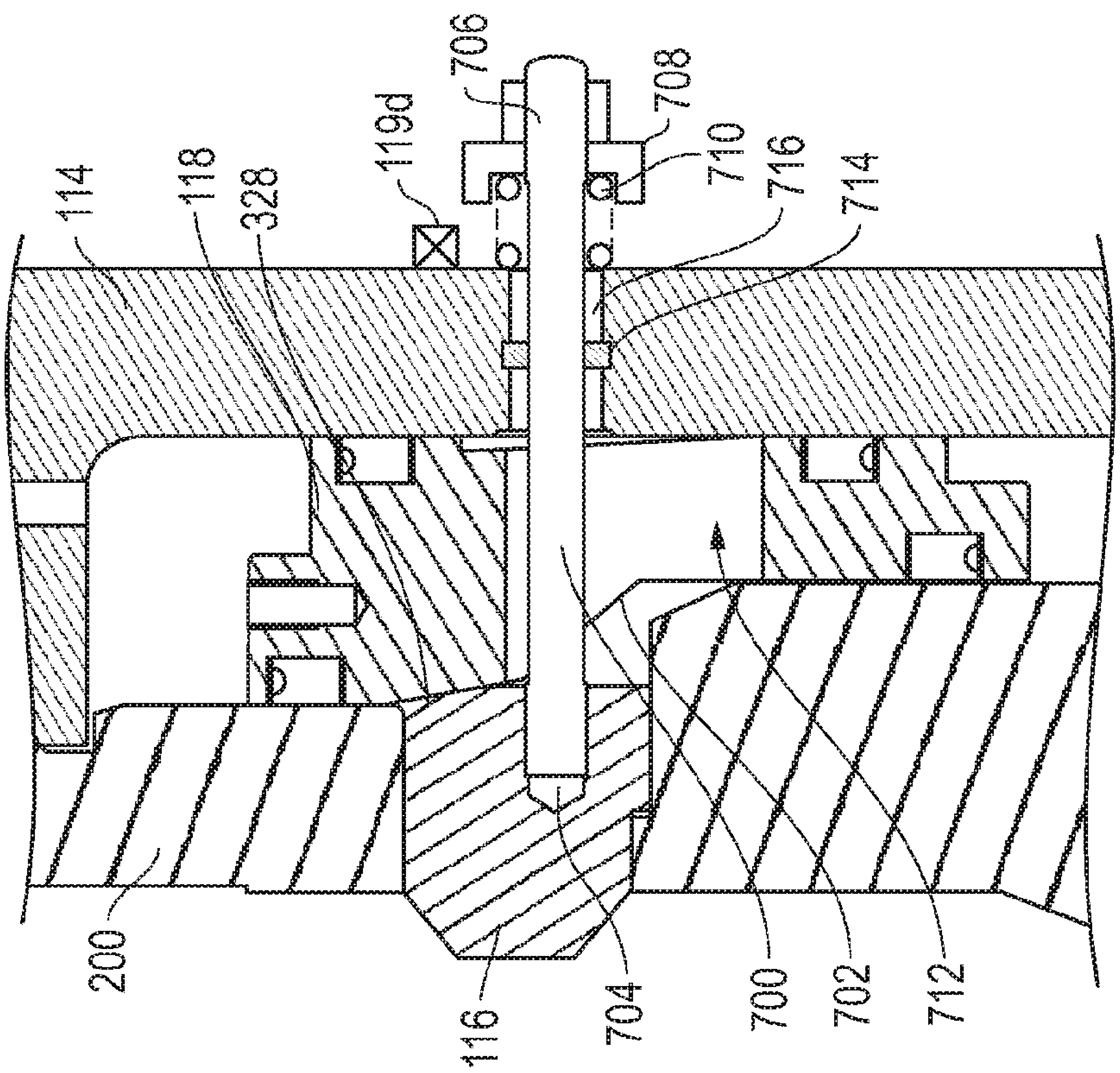


FIG. 14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708
710
716
714
119d
114
118
328
200
116
704
700
702
712

FIG. 16

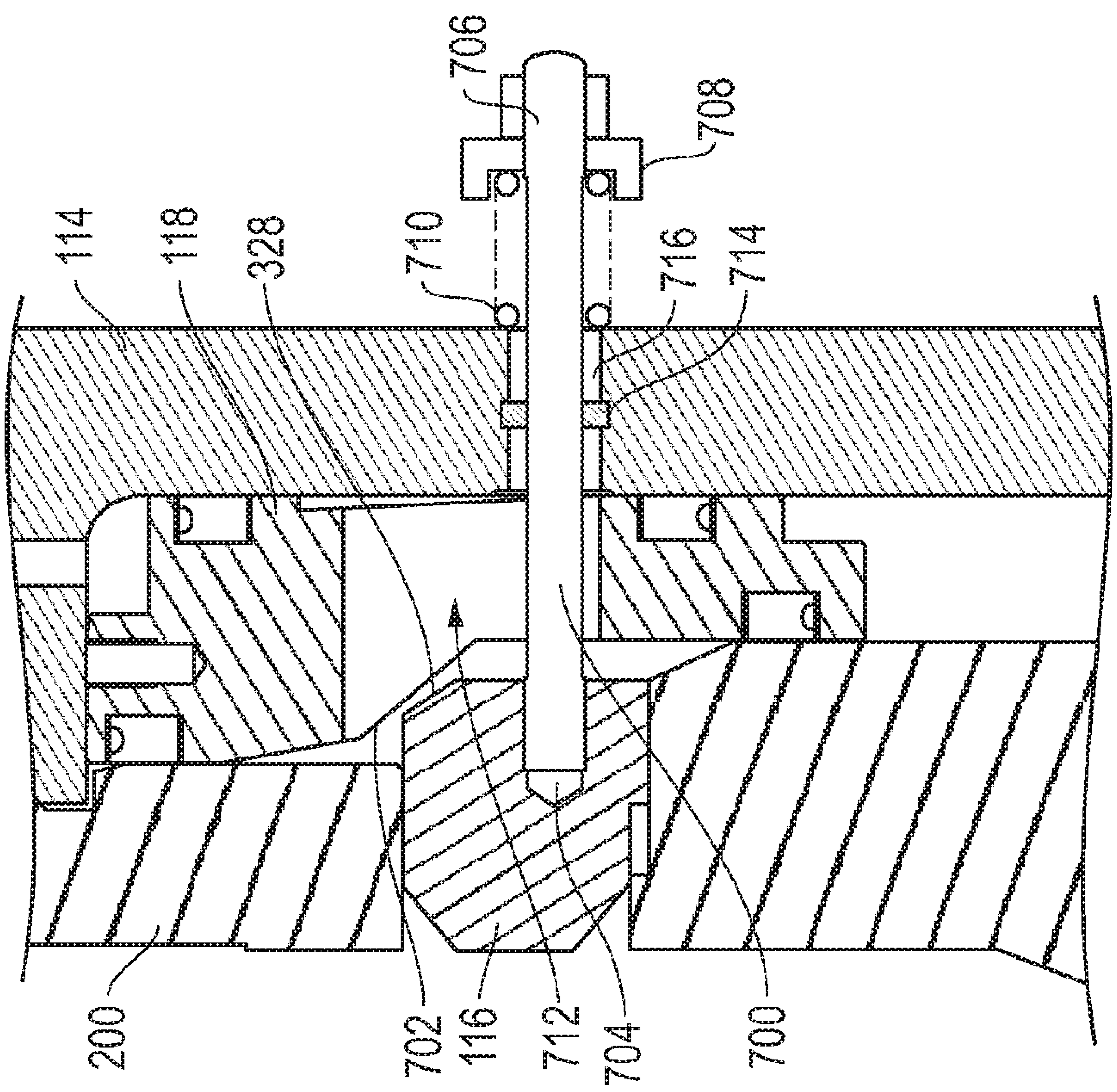

706
708
710
716
714
114
118
328
200
702
116
712
704
700

FIG. 15

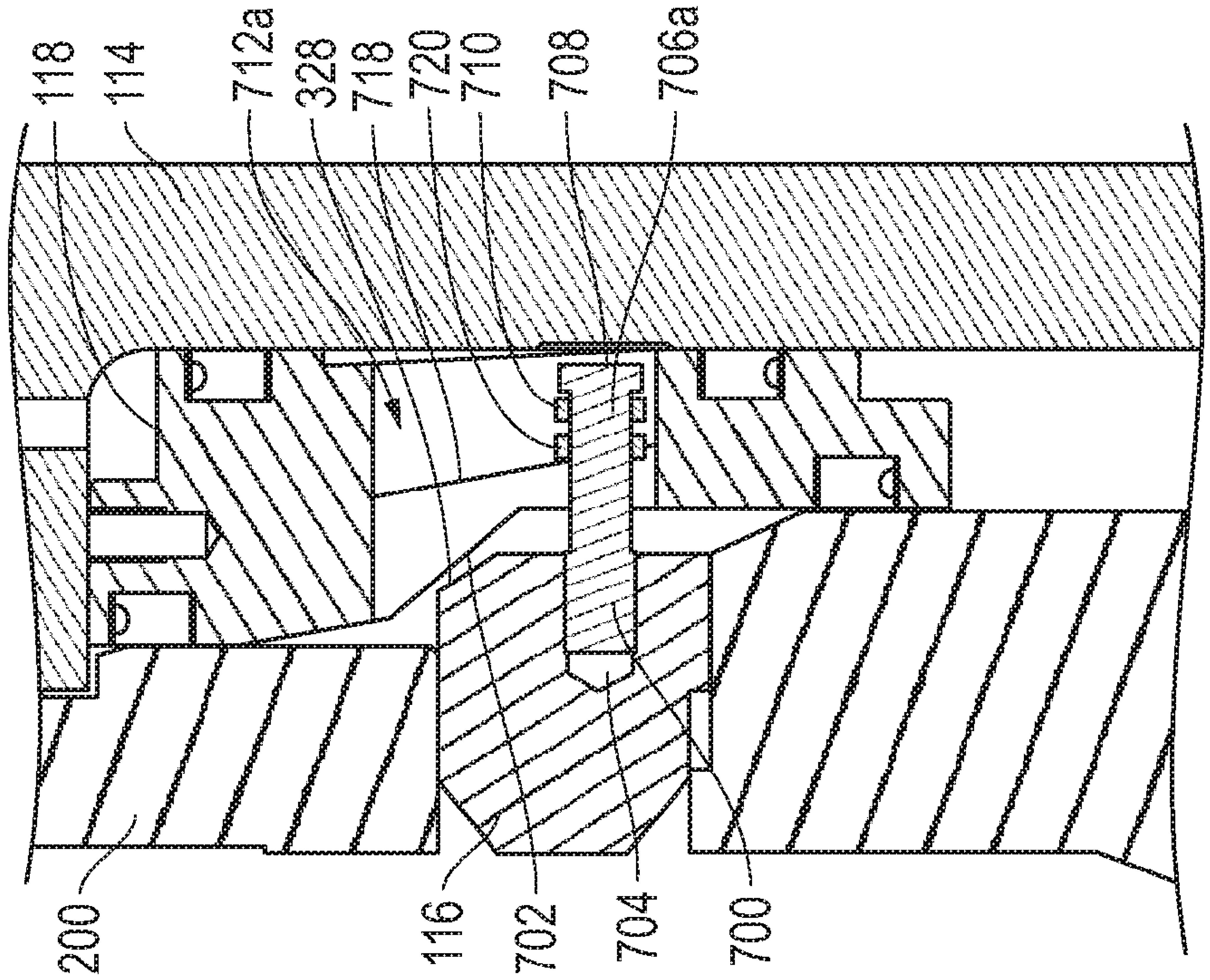

118
114
712a
328
718
720
710
708
706a
200
116
702
704
700

FIG. 18

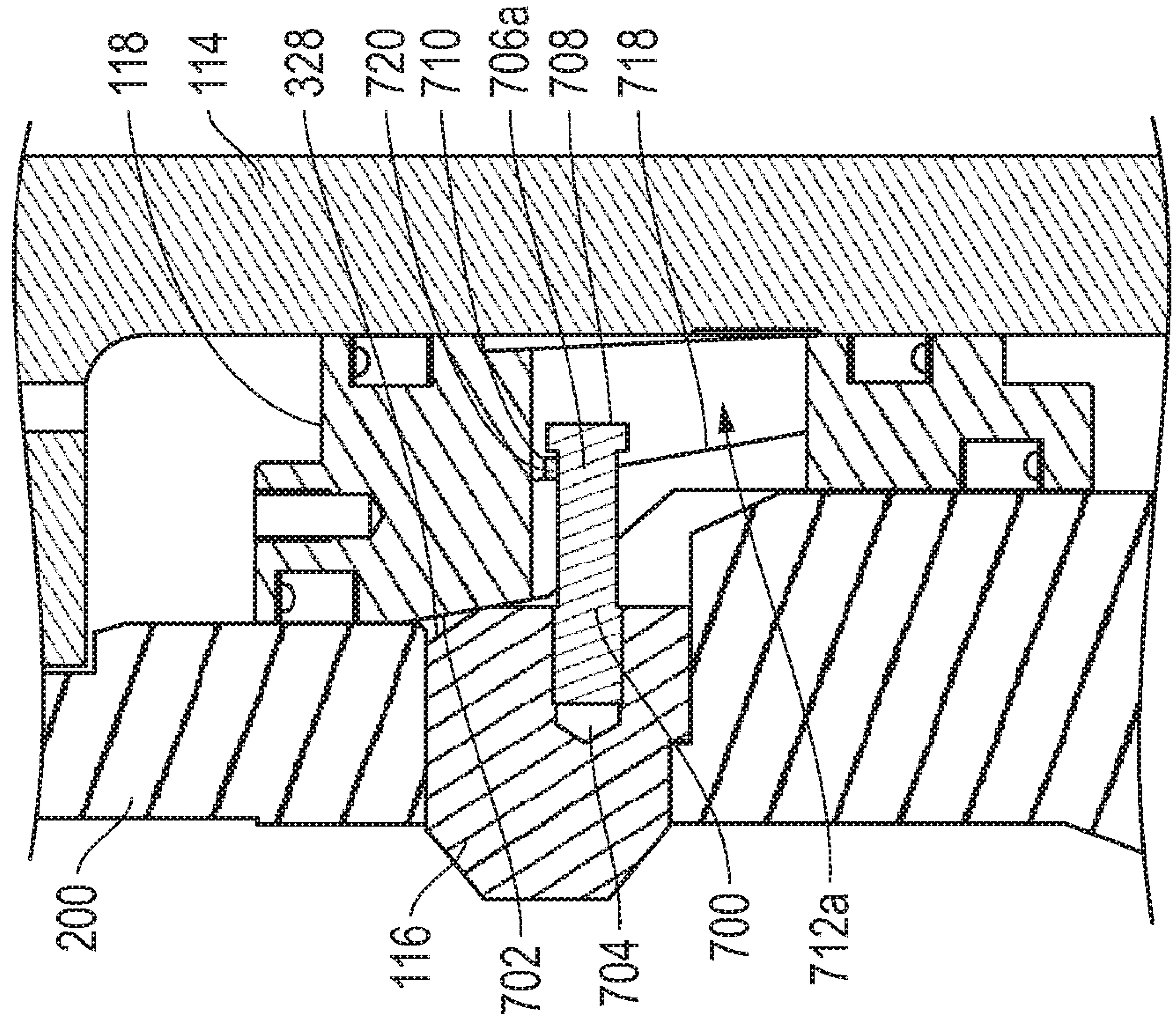

118
114
328
720
710
706a
708
718
200
116
702
704
700
712a

FIG. 17

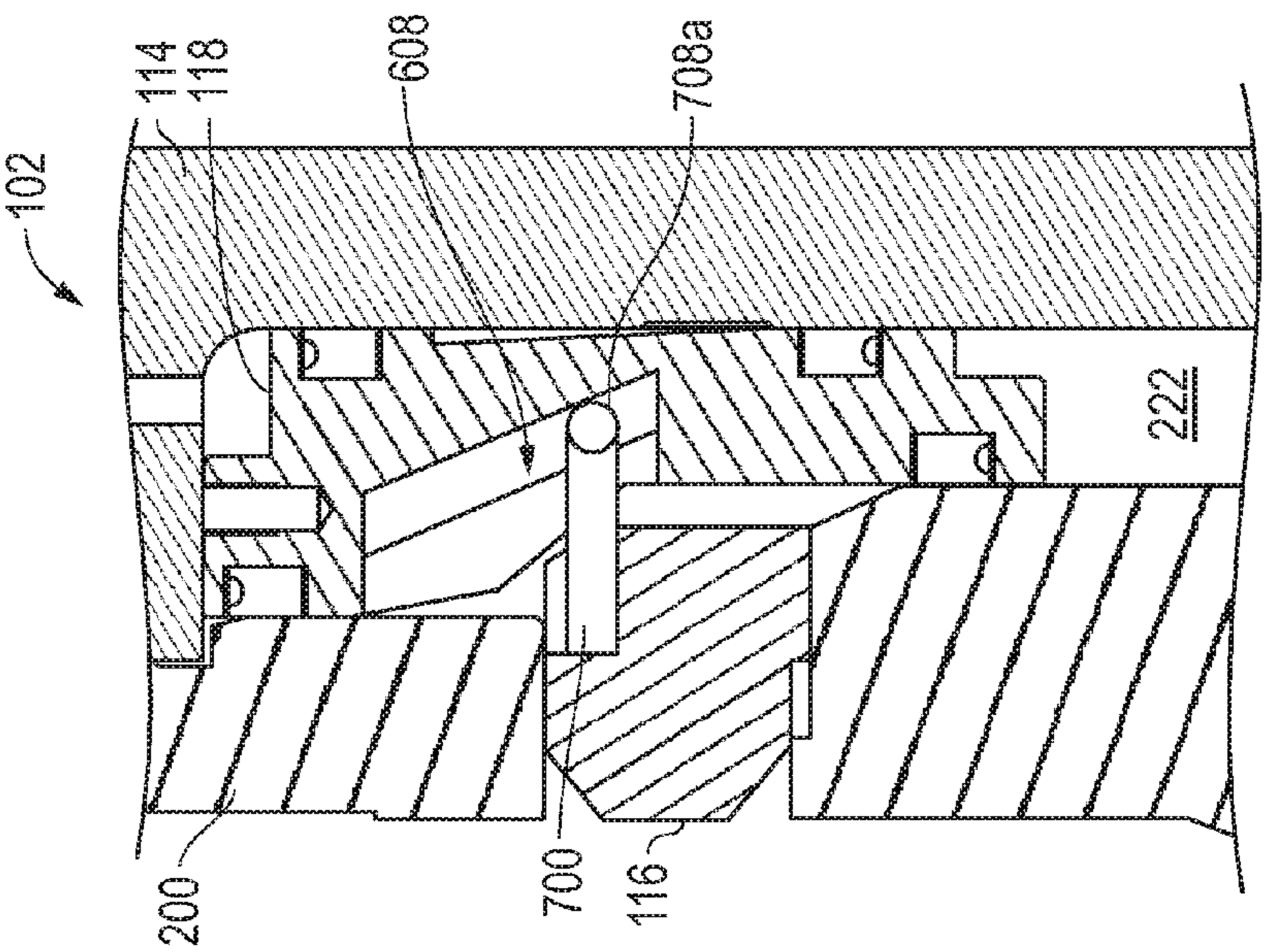

102
114
118
608
708a
222
200
700
116

FIG. 20

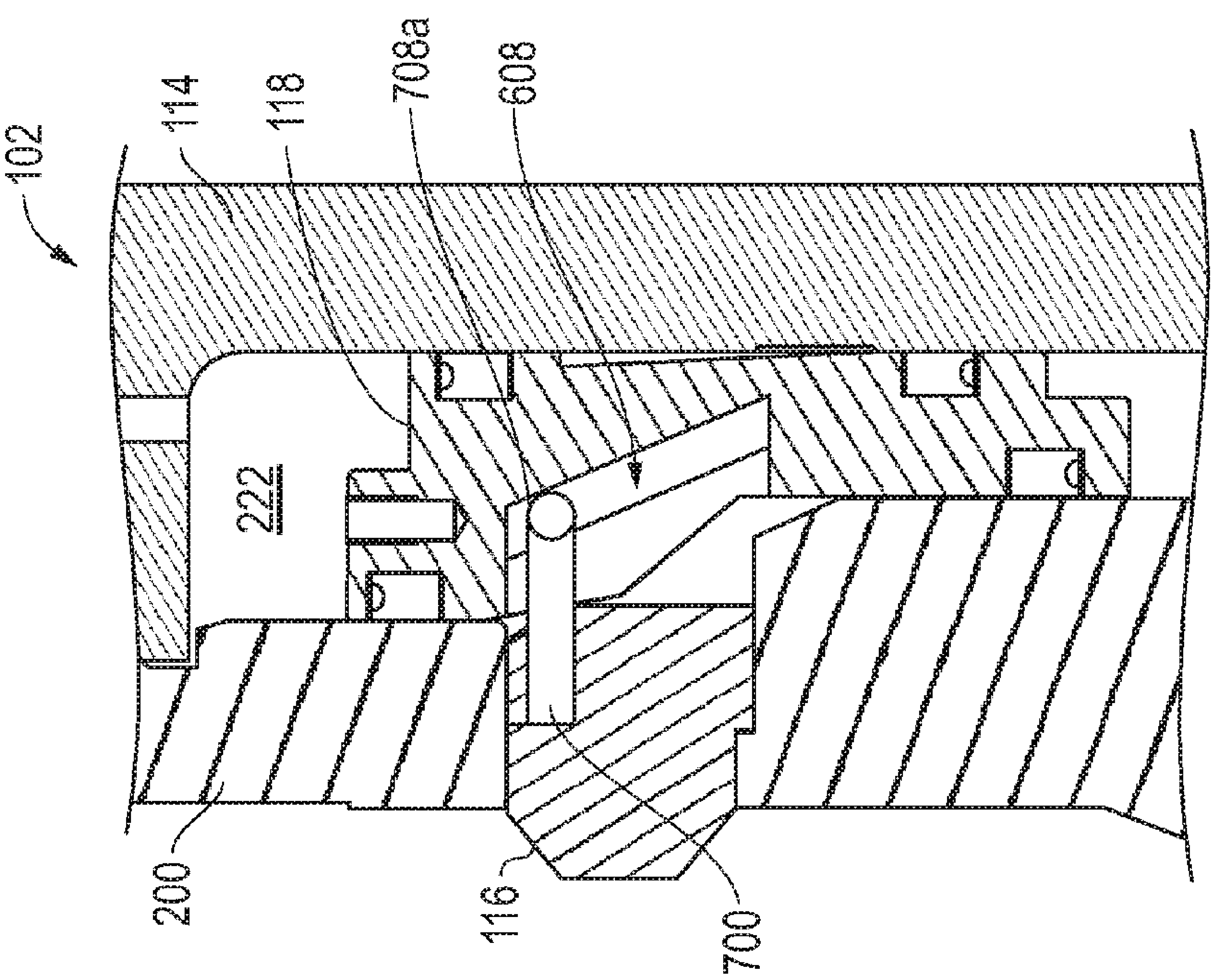

102
114
118
708a
608
222
200
116
700

FIG. 19

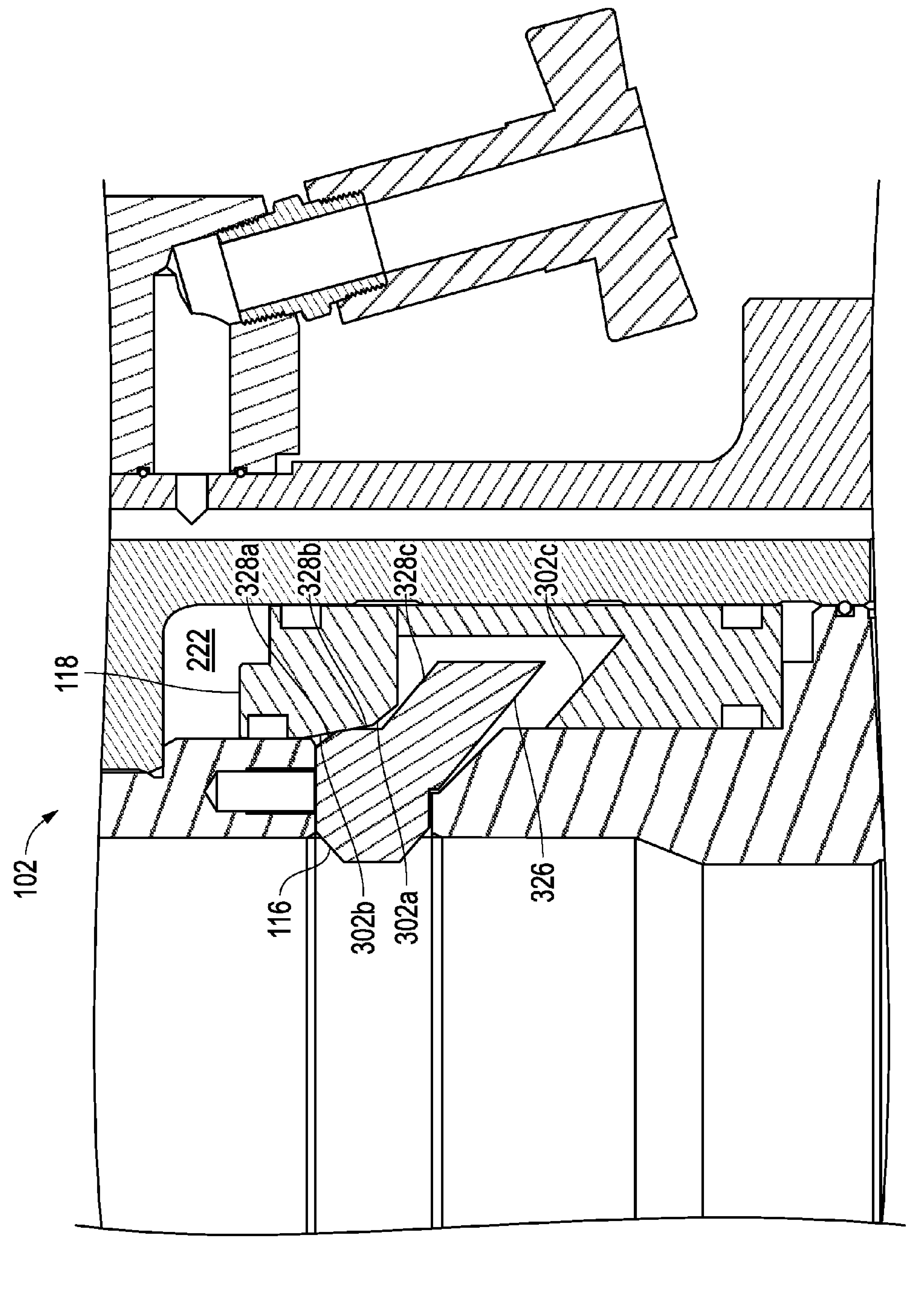


FIG. 21

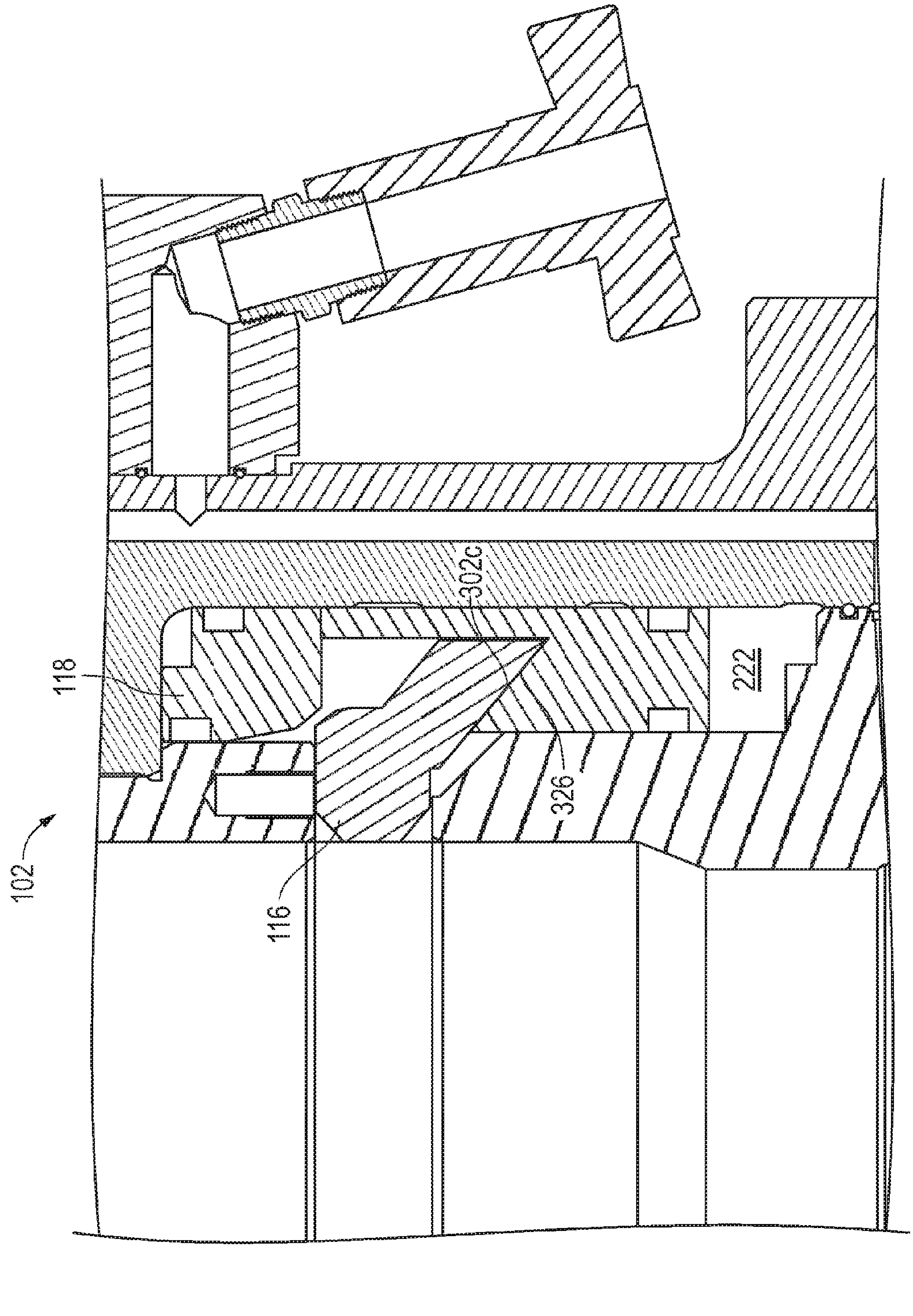


FIG. 22

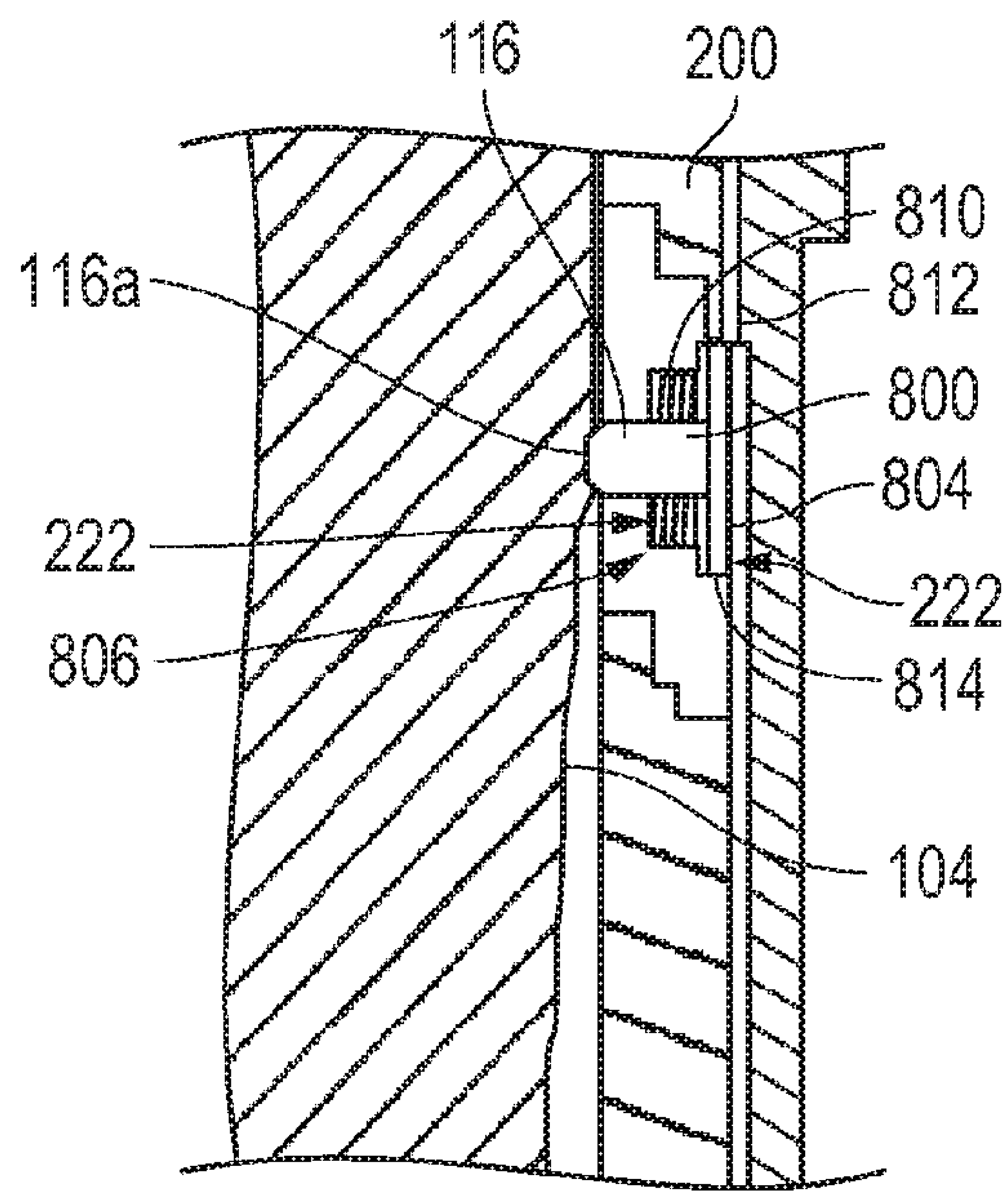
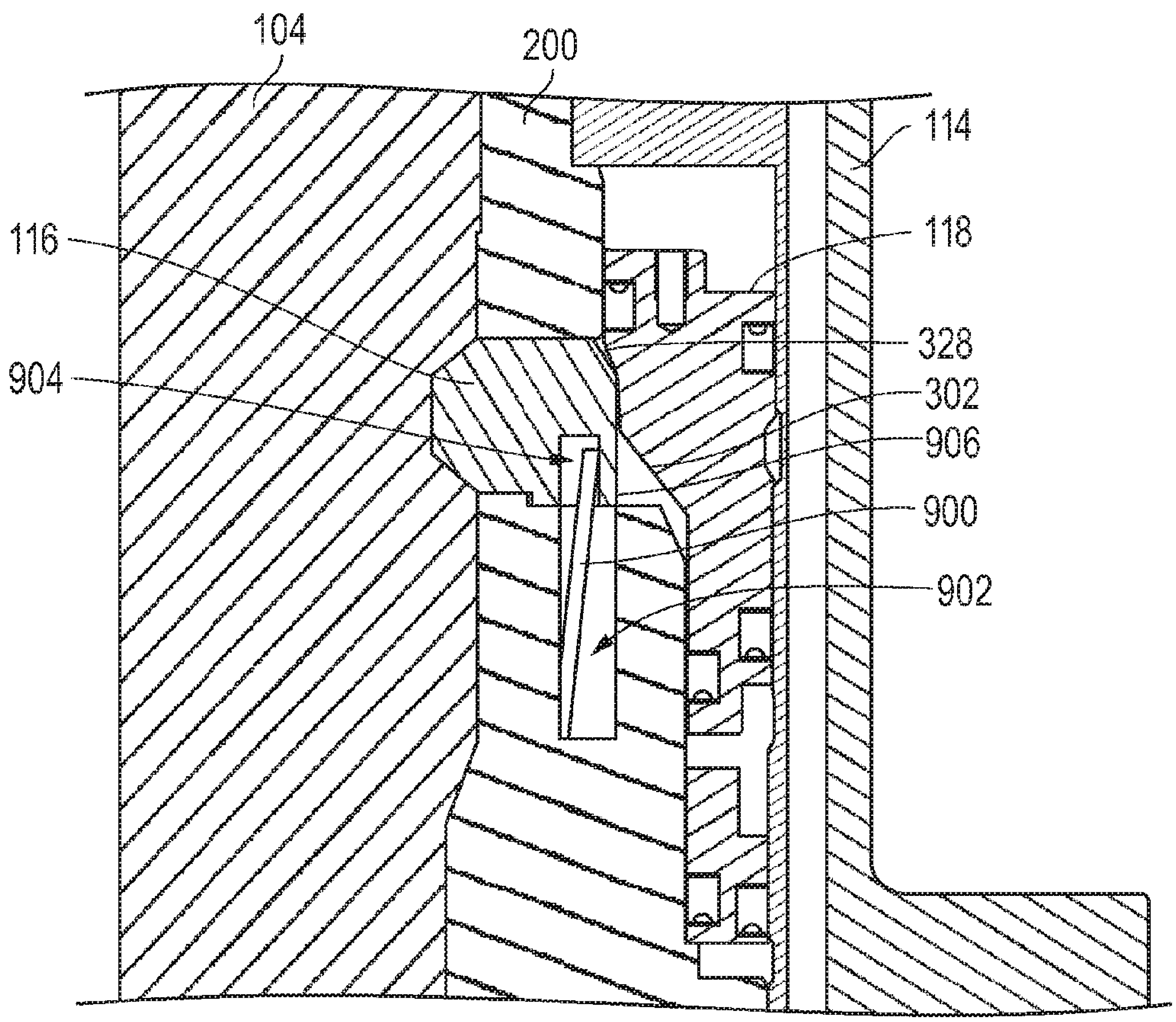

116
200
810
116a
812
800
804
222
222
806
814
104

FIG. 23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200
114
116
118
328
904
302
906
900
902

FIG. 24

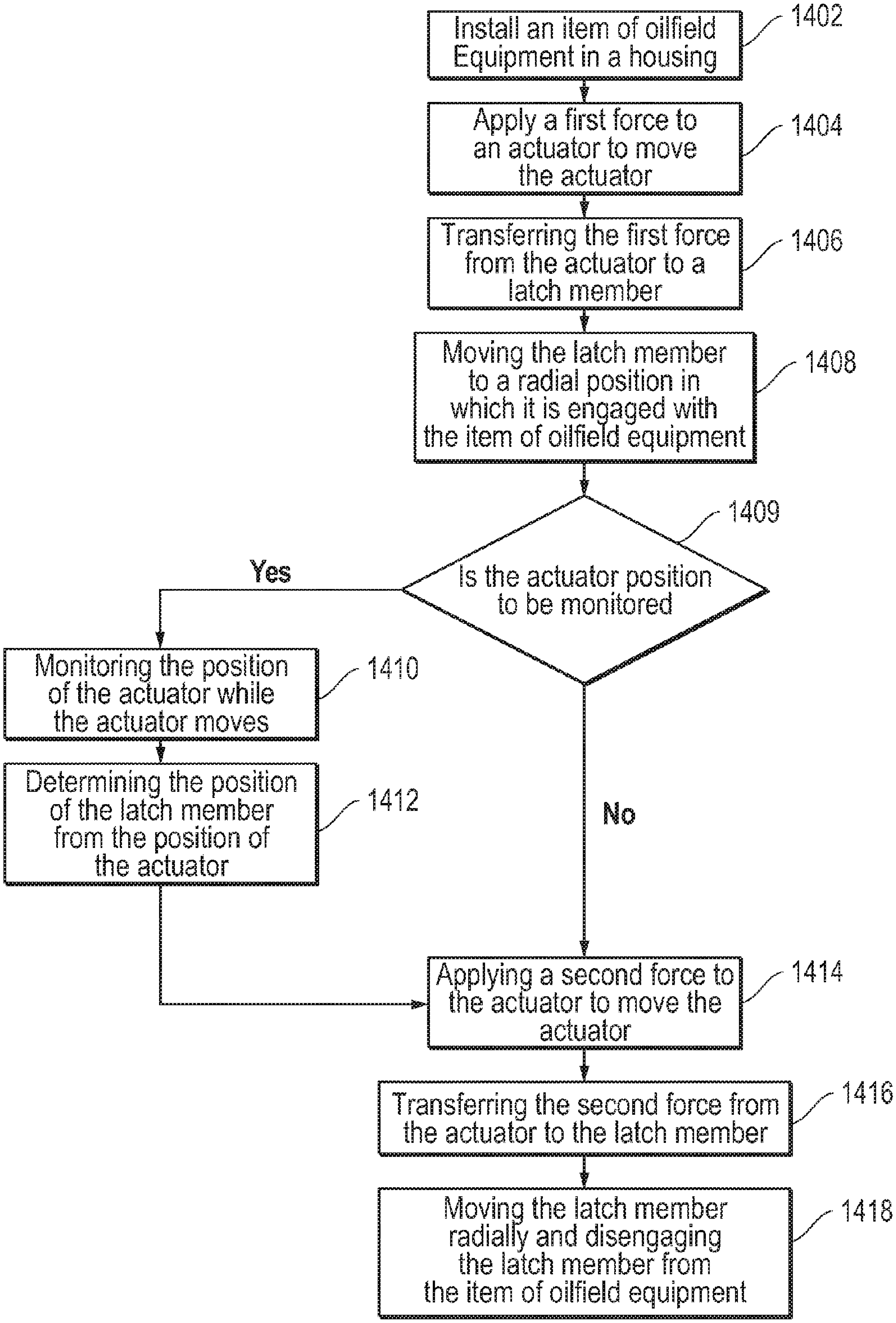
Install an item of oilfield Equipment in a housing
1402
Apply a first force to an actuator to move the actuator
1404
Transferring the first force from the actuator to a latch member
1406
Moving the latch member to a radial position in which it is engaged with the item of oilfield equipment
1408
Is the actuator position to be monitored
1409
Yes
Monitoring the position of the actuator while the actuator moves
1410
Determining the position of the latch member from the position of the actuator
1412
No
Applying a second force to the actuator to move the actuator
1414
Transferring the second force from the actuator to the latch member
1416
Moving the latch member radially and disengaging the latch member from the item of oilfield equipment
1418

FIG. 25

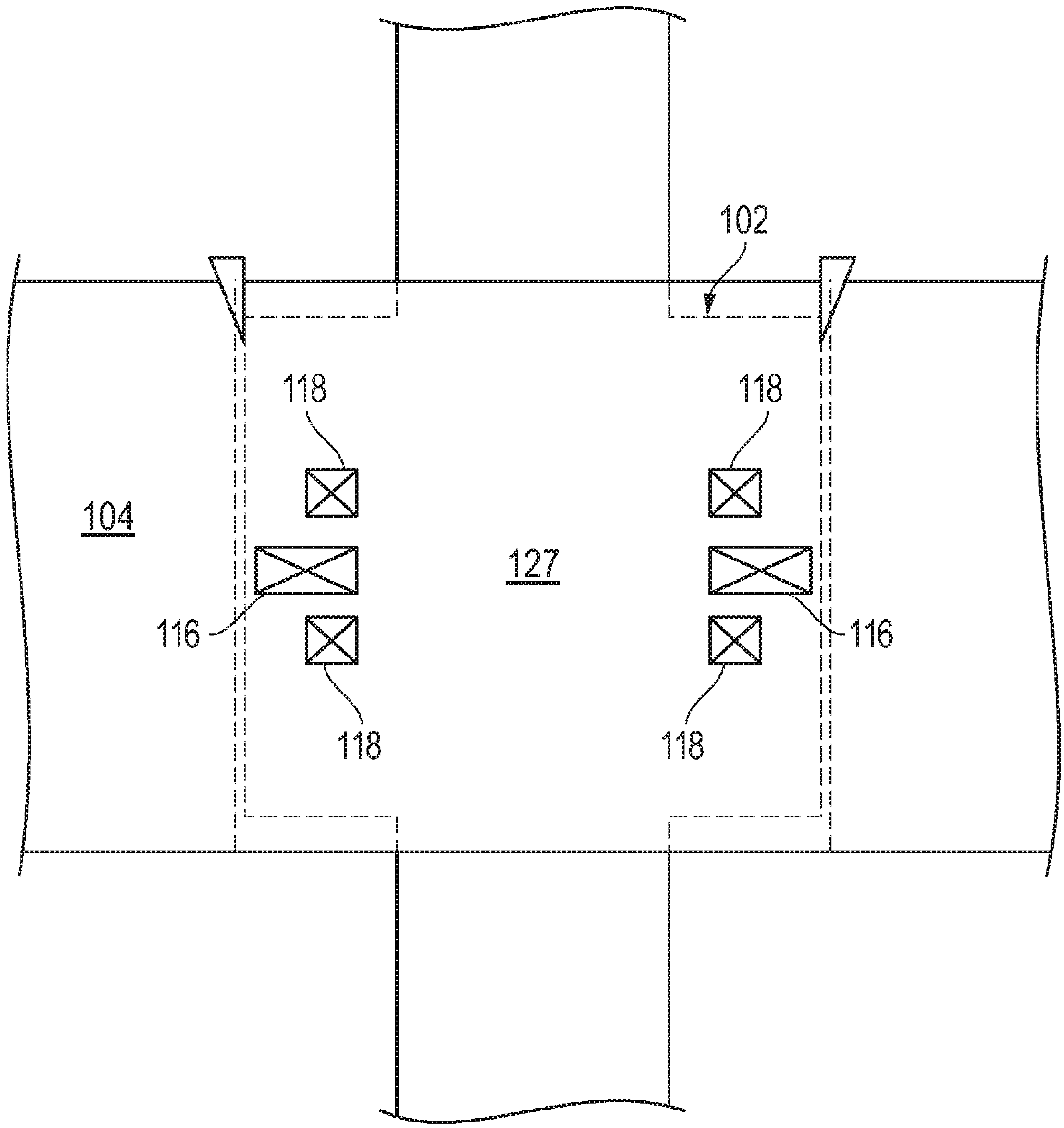

FIG. 26

POSITIVE RETRACTION LATCH LOCKING DOG FOR A ROTATING CONTROL DEVICE

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of U.S. Provisional Application No. 61/365,288 filed Jul. 16, 2010.

STATEMENTS REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

Not Applicable.

NAMES OF THE PARTIES TO A JOINT RESEARCH AGREEMENT

Not Applicable.

BACKGROUND

Oilfield operations may be performed in order to extract fluids from the earth. When a well site is completed, pressure control equipment may be placed near the surface of the earth. The pressure control equipment may control the pressure in the wellbore while drilling, completing and producing the wellbore. The pressure control equipment may include blowout preventers (BOP), rotating control devices, and the like.

The rotating control device or RCD is a drill-through device with a rotating seal that contacts and seals against the drill string (drill pipe, casing, drill collars, kelly, etc.) for the purposes of controlling the pressure or fluid flow to the surface. For reference to an existing description of a rotating control device incorporating a system for indicating the position of a latch in the rotating control device, please see US patent publication number 2009/0139724 entitled "Latch Position Indicator System and Method", U.S. application Ser. No. 12/322,860, filed Feb. 6, 2009, the disclosure of which is hereby incorporated by reference. This publication describes a rotating control device having a latch system used for securing and releasing bearings and stripper rubber assemblies into and out of the housing for the rotating control device.

Prior latch systems have a tendency to jam, stick, catch or become lodged in an engaged position with the oilfield equipment. When the latch is jammed, oilfield equipment and/or the pressure control systems may become damaged. Further when the latch is jammed, rig time is lost to repair the damaged equipment. There is a need for more efficient latching and unlatching of items of oilfield equipment.

SUMMARY

A latch and method for use is provided for latching an item of oilfield equipment. The latch has a housing containing a latch member, and the latch member is movable between a radially engaged position in which it is engaged with the item of oilfield equipment, and a radially retracted position in which it is disengaged from the item of oilfield equipment. An actuator is configured to drive the latch member into the radially engaged position. Further, the actuator is configured to drive the latch member toward the radially retracted position.

As used herein the terms "radial" and "radially" include directions inward toward (or outward away from) the center axial direction of the drill string or item of oilfield equipment but not limited to directions perpendicular to such axial direction or running directly through the center. Rather such directions, although including perpendicular and toward (or away from) the center, also include those transverse and/or off center yet moving inward (or outward), across or against the surface of an outer sleeve of item of oilfield equipment to be engaged.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** depicts a schematic view of a wellsite.

FIG. **2**A depicts a cross-sectional view of an RCD according to an embodiment.

FIG. **2**B depicts a cross-sectional view of a portion of a latch in the RCD according to an embodiment.

FIG. **3** depicts a cross-sectional view of a portion of the latch according to an embodiment.

FIG. **4** depicts a perspective view of a latch member according to an embodiment.

FIG. **5** depicts a schematic cross-sectional view of a latch according to an embodiment.

FIG. **6** depicts a cross-sectional view of an embodiment of a portion of the latch operating in an intermediate position.

FIG. **7** depicts a cross-sectional view of an embodiment of a portion of the latch operating in an engaged position.

FIG. **8** depicts a cross-sectional view of an embodiment of a portion of the latch operating in a closed position but without engaging any suitable oilfield equipment.

FIG. **9** depicts a cross-sectional view of an embodiment of a portion of a latch which has not self-released from the engaged or closed position.

FIG. **10** depicts a cross-sectional view of an embodiment of a portion of the latch operating to positively drive the latch to the disengaged position.

FIG. **11** depicts a cross-sectional top view of the latch disengaged according to an embodiment.

FIG. **12** depicts a cross-sectional top view of the latch engaged according to an embodiment.

FIG. **13**A depicts a schematic alternative embodiment of the latch.

FIG. **13**B depicts a view of the embodiment of FIG. **13**A taken along line **13**B-**13**B.

FIG. **14** depicts a cross-sectional view of a portion of the latch according to another embodiment.

FIG. **15** depicts a cross-sectional view of a portion of the latch showing the latch in the disengaged position according to another embodiment.

FIG. **16** depicts a cross-sectional view of a portion of the latch showing the latch in the engaged position according to another embodiment.

FIG. **17** depicts a cross-sectional view of a portion of the latch showing the latch in the engaged position according to another embodiment.

FIG. **18** depicts a cross-sectional view of a portion of the latch showing the latch in the disengaged position according to another embodiment.

FIG. **19** depicts a cross-sectional view of a portion of the latch showing the latch in the engaged position according to another embodiment.

FIG. **20** depicts a cross-sectional view of a portion of the latch showing the latch in the disengaged position according to another embodiment.

FIG. **21** depicts a cross-sectional view of a portion of the latch showing the latch in the engaged position according to another embodiment.

FIG. **22** depicts a cross-sectional view of a portion of the latch showing the latch in the disengaged position according to another embodiment.

FIG. **23** depicts a cross-sectional view of a portion of the latch showing the latch in the engaged position according to another embodiment.

FIG. **24** depicts a cross-sectional view of a portion of the latch showing the latch in the engaged position according to another embodiment.

FIG. **25** depicts a method of using the latch.

FIG. **26** depicts a schematic view of a portion of another embodiment of a wellsite.

DETAILED DESCRIPTION OF EMBODIMENT(S)

The description that follows includes exemplary apparatus, methods, techniques, and instruction sequences that embody techniques of the inventive subject matter. However, it is understood that the described embodiments may be practiced without these specific details.

FIG. **1** depicts a schematic view of a wellsite **100** having a latch **102** for latching to an item or piece of oilfield equipment **104**. The wellsite **100** may have a wellbore **106** formed in the earth and lined with a casing **108**. At the earth's surface **110** one or more pressure control devices **112** may control pressure in the wellbore **106**. The pressure control devices **112** may include, but are not limited to, BOPs, RCDs, and the like. The latch **102** is shown and described herein as being located in a housing **114**. The latch **102** may have one or more latch members **116** configured to engage the oilfield equipment **104**. The latch **102** may have one or more actuators **118** configured to drive the latch into and out of engagement with the oilfield equipment **104**. The latch **102** may further include one or more sensors **119** configured to identify the status of the latch **102**.

The wellsite **100** may have a controller **120** for controlling the latch **102**. In addition to controlling the latch **102**, the controller **120**, and/or additional controllers (not shown), may control and/or obtain information from any suitable system about the wellsite **100** including, but not limited to, the pressure control devices **112**, the housing **114**, the sensor(s) **119**, a gripping apparatus **122**, a rotational apparatus **124**, and the like. As shown, the gripping apparatus **122** may be a pair of slips configured to grip a tubular **125** (such as a drill string, a production string, a casing and the like) at a rig floor **126**, however, the gripping apparatus **122** may be any suitable gripping device. In addition, operation of the gripping apparatus **122** may be prevented when sensor(s) **119** detect that the latch **102** is in the radial engaged position. As shown, the rotational apparatus **124** is a top drive for supporting and rotating the tubular **125**, although it may be any suitable rotational device including, but not limited to, a Kelly, a pipe spinner, and the like. The controller **120** may control any suitable equipment about the well site **100** including, but not limited to, a draw works, a traveling block, pumps, mud control devices, cementing tools, drilling tools, and the like.

FIG. **2**A depicts a cross sectional view of the housing **114** having the latch **102** according to an embodiment. The housing **114**, as shown, has the latch member or "dog" **116**, the one or more actuators **118**, a latch housing **200** (or housing pieces), a bottom flange **202**, a flow control portion **204**, and an overshot mandrel **206**. The latch **102** as shown is configured to latch to an outer sleeve **208** of a bearing **210**. The latch **102** may secure the outer sleeve **208** in place while allowing the bearing **210** to rotate and/or absorb forces caused by rotating tubulars being run into and/or out of the wellbore **106**. Although the latch **102** is shown and described as latching to an outer sleeve **208**, it may latch to any suitable oilfield equipment including, but not limited to, an RCD, a bushing, a bearing, a bearing assembly, a test plug, a snubbing adaptor, a docking sleeve, a sleeve, sealing elements, and the like.

The bottom flange **202** may be for coupling the housing **114** to the other pressure control devices **112** (as shown in FIG. **1**). The flow control portion **204** may be configured to control annular pressure in the housing **114** and/or the wellbore **106**. The overshot mandrel **206** may be configured to receive and/or guide the tubular **125** (as shown in FIG. **1**) as it enters the housing **114**.

The latch housing **200** as shown in FIG. **2**A may define an opening **212** (or channel) for receiving the outer sleeve **208**, or other oilfield equipment. The opening **212** may have an upset **214**, or shoulder, (as shown in FIG. **2**B) for receiving and/or supporting a matching profile **216** on the outer sleeve **208**. The latch housing **200** may have an annular opening **218** therethrough that allows the latch member **116** to pass through the latch housing **200** and engage the outer sleeve **208**. Referring to FIG. **3**, the latch housing **200** may having one or more slots **220** formed across top and/or the bottom of the annular opening **218**. The slots **220** may allow fluids to pass therethrough while the latch member **116** travels between an engaged position radially inward (or outward as case may be) and a disengaged position radially retracted or outward (or inward as case may be). In addition an annular slot **221** may be configured to allow fluids to move between the latch housing **200** and the outer sleeve **208** and/or oilfield equipment **104**. The slots **220** and/or **221** function to relieve or inhibit the build-up of pressure and/or debris in spaces around the outside of the latch member **116**. The source of such pressure and/or debris could be the wellbore pressure and/or a leaking seal.

The latch housing **200** may further define an actuator cavity **222**. The actuator cavity **222** may be configured to substantially house the actuators **118**. The actuator cavity **222** may have any number of ports **223** therethrough for supplying fluid pressure to the actuators **118**. The fluid pressure may be pneumatic or hydraulic pressure. The actuator cavity **222** as shown is an annular cavity configured to house the actuators **118**. The actuator cavity **222** may be in communication with the slots **220** and the annular opening **218** in order to allow the actuators **118** to move the latch member **116** between the engaged and disengaged positions. Although the latch housing **200** is shown having an annular opening **218** and the actuator cavity **222**, it should be appreciated that the annular opening **218** may be several openings around the latch housing **200** and the actuator cavity **222** may be several cavities located around the latch housing **200** each housing separate actuators **118**.

The actuators **118** are configured to actuate, or drive, the latch member **116** radially engaged and into engagement with outer sleeve **208**, or other oilfield equipment. The actuators **118** are also configured to actuate, or drive, the latch member **116** radially outward and into the latch housing **200**. As shown in FIG. **2**B the actuators **118** comprise an engagement or first actuator **224**, or engagement piston, and a disengagement or second actuator **226**, or disengagement piston. Optionally the actuators **118** may have a secondary disengagement actuator **228**. The engagement actuator **224** moves the latch member **116** toward the engaged position. The disengagement actuator **226** moves the latch member **116** into the disengaged position thereby allowing the outer sleeve **208**, or oilfield equipment **104** to be removed from the housing **114**. The secondary disengagement actuator **228** may be used to increase the removal force on the latch member **116** in the event the latch member **116** becomes stuck and/or jammed in the engaged position.

FIG. **3** depicts a blown up view of the latch **102** according to an embodiment. The latch member(s) **116** is in a position interposed with respect to the engagement actuator **224** and the disengagement actuator **226**. The engagement actuator **224** as shown in FIG. **2**B is an annular piston configured to move toward the latch member(s) **116** when the fluid pressure is applied to a piston surface **300***a* via the port **223**. Fluid may enter a fluid chamber **301***a* and/or **301***b* in order to move the engagement actuator **224** and the disengagement actuator **226** respectively. The fluid may be hydraulic or pneumatic fluid. The engagement actuator **224** may have at least one ramp **302***a*, interface, or drive surface, to drive the latch member **116** radially inward toward the engaged position. The engagement actuator **224** as shown has two ramps **302***a* and **302***b* (which when impacting the one or more latch members **116** form contiguous interfaces therewith). The ramp **302***a* may have a steep incline relative to the latch member **116**. The steep incline may increase the radial distance traveled by the latch member **116** with very little linear movement of the engagement actuator **224**. Therefore, upon actuation of the engagement actuator **224**, the latch member may quickly be moved to a location proximate the outer sleeve **208**, or oilfield equipment **104**. The ramp **302***a* may have an incline between twenty-five and fifty-five degrees. In another embodiment, the ramp **302***a* has an incline between thirty and forty degrees.

The ramp **302***b* may have a shallow incline relative to the latch member **116**. The shallow incline may be configured to move the latch member **116** radially at a slower rate per the linear movement of the engagement actuator **224**. The shallow incline may act as a self-lock on the latch member **116** (against, for example, wellbore pressure) if fluid pressure is lost on the piston surface **300***a*. The shallow incline may be between one and twenty degrees in an embodiment. In another embodiment, the shallow incline may be between nine and ten degrees. Although, the engagement actuator **224** is shown as having two ramps **302***a* and **302***b*, there may be any suitable number of ramps including one, two, three or more.

The engagement actuator **224** may have an engagement shoulder **304**. The engagement shoulder **304** may be configured to be engaged by a nose **306** of the disengagement actuator **226**. Therefore, the nose **306** of the disengagement actuator **226** may be used to apply force to the engagement actuator **224**. When the force applied by the nose **306** is large enough to overcome the force applied on the engagement actuator **224** by the fluid pressure, the engagement actuator **224** will move linearly away from the latch member **116**. This may free the latch member **116** to bias back toward the disengagement position, or be moved toward the disengagement position by the disengagement actuator **226**. The engagement actuator **224** may have any number of seal pockets **308***a*, **308***b*, and **308***c* for housing seals **310***a*, **310***b* and **310***c*. The seals **310***a*, **310***b* and **310***c* may prevent fluid from passing between the surfaces of the engagement actuator **224**, the latch housing **200**, and/or the disengagement actuator **226**.

The disengagement actuator **226** may have a piston surface **300***b* for motivating the disengagement actuator **226** toward the latch member **116** and/or the engagement actuator **224**. The disengagement actuator **226** may have a ramp (interface, or drive surface) **302***c* (which when impacting the one or more latch members **116** form contiguous interfaces therewith) for engaging the latch member **116** and moving, retracting or driving, the latch member radially away from the outer sleeve **208**, or oilfield equipment and into the disengaged position. As shown, the ramp **302***c* may have an incline between the steep and shallow incline of the engagement actuator **224**, or an incline similar to the steep and/or shallow incline of the engagement actuator **22**. In another embodiment, the disengagement actuator **226** may have two ramps (only one depicted) similar to the ramps **302***a* and **302***b* of the engagement actuator **224**. The disengagement actuator **226** may have any number of seal pockets **308***d* and **308***e* for housing seals **310***d* and **310***e*. The seals **310***d* and **310***e* may prevent fluid from passing between the surfaces of the engagement actuator **224**, the latch housing **200**, and/or the disengagement actuator **226**.

The disengagement actuator **226** may have a ram **312**. The ram **312** may extend past the latch member **116** for engaging the engagement shoulder **304** with the nose **306**. As fluid pressure is applied to the disengagement actuator **226**, the nose **306** may engage the engagement shoulder **304** thereby moving the engagement actuator **224** away from the latch member **116**. As the disengagement actuator **226** moves the engagement actuator **224**, the ramps **302***a* and **302***b* may be disengaged from the latch member **116**. The continued movement of the disengagement actuator **226** may engage the ramp **302***c* with the latch member **116** in order to directly and positively move/force the latch member **116** toward the disengaged position. Although the disengagement actuator **226** is shown as a separate piece from the engagement actuator **224**, it should be appreciated that they may be integral.

The ram **312** may have a position ramp **314** located on one side. The sensor **119** may be used to determine the position or distance of/to the position ramp **314** relative to the latch housing **200**. For example, the sensor **119** may be an optical sensor which determines the distance between the position ramp **314** and the sensor **119**. By knowing the distance, the exact linear positions of the disengagement actuator **226** and the engagement actuator **224** may be determined. The location of the engagement actuator **224** and the disengagement actuator **226** may allow the operator and/or the controller **120** to determine the exact position of the latch member **116**. Although the sensor **119** is described as being an optical sensor any suitable type of sensor may be used including, but not limited to, an infrared sensor, a mechanical sensor, a piston type sensor, a strain gauge, and the like.

Additional sensors **119** may be located about the latch housing **200** in order to determine the location of the actuators **118**. For example, sensors **119***a* and **119***c* may be placed near a terminal end **316***a* and **316***b* of the actuator cavity **222**. The sensors **119***a* and **119***c* may allow the operator and/or the controller **120** to determine if the engagement actuator **224** and/or the disengagement actuator **226** have reached the terminal ends **316***a* and **316***b* respectively. In addition, the volume, flow rate and/or the pressure of the fluid entering and/or leaving the fluid chambers **301***a* and/or **301***b* may be measured (or sensed proximate sensors **119**) and optionally recorded in order to determine the location of the actuators **118**.

The latch member **116** may have an engagement portion **318** and an actuator portion **320**. The engagement portion **318** may have one or more profiles **322***a* and **322***b* configured to engage and secure to a matching profile **324** of the outer sleeve **208**. Therefore, when the latch member **116** is in the engaged position, the one or more profiles **322***a* and **322***b* engage the matching profile **324** of the outer sleeve **208** thereby preventing the outer sleeve **208** from moving linearly in the housing **114**. The incline of the one or more profiles **322***a* and **322***b* may self align the outer sleeve **208** as the latch member **116** moves toward the engaged position.

The actuator portion **320** may have an engagement edge **325** and a disengagement ramp **326**. The engagement edge **325** may be a ramp or ramps, elliptical, a radius, or corner of the latch member that is engaged by the ramps (or correspondingly matched surfaces) **302***a* and/or **302***b* of the engagement actuator **224**. As shown, the engagement edge **325** has two engagement ramps **328***a* and **328***b*. The ramps **328***a* and **328***b* may mirror the incline of the ramps **302***a* and **302***b*, or have another incline.

The disengagement ramp **326** may be configured to be engaged by the ramp **302***c* of the disengagement actuator **226**. As shown, the disengagement ramp **326** protrudes into the actuator cavity **222**. As the disengagement actuator **226** moves up the ramp **302***c* engages the disengagement ramp **326**. Continued linear movement of the disengagement actuator **226** moves the latch member **116** toward the disengaged position via the disengagement ramp **326**.

FIG. **4** is a schematic perspective view of the latch member **116** according to an embodiment. As shown the latch member **116** is a C-ring **400**. The C-ring **400** may have a gap **402** which is collapsed as the engagement actuator **224** moves the C-ring **400** toward the engaged position. The C-ring **400** may naturally be in the disengaged position. Therefore, as the engagement actuator **224** collapses the gap **402** and moves the latch member **116** toward the engaged position the latch member is biased toward the disengaged position. The C-ring acts as an energizable spring (i.e. such that the gap **402** enables the C-ring **400** to be squeezed in and to spring out. Therefore, typically when the engagement actuator **224** is moved clear of the latch member **116**, the latch member **116** will move to the disengaged position. In addition to the slots **220** (as shown in FIG. **2**) the C-ring **400** may have any number of slots, or ports therethrough to allow from fluid to pass as the C-ring **400** moves between the engaged and disengaged position. Although, the C-ring **400** is described as being biased toward the disengaged position, it should be appreciated that it may be biased toward the engaged position. Biasing the latch member closed may act as a fail safe feature in the event that fluid pressure is lost on the engagement actuator **224**, or piston while the oilfield equipment **104** and/or outer sleeve **208** are engaged. The closed bias would prevent the oilfield equipment **104** and/or outer sleeve **208** from becoming inadvertently released.

FIG. **5** depicts a schematic top view of an alternative latch member **500**. The alternative latch member **500** may have several locking dogs **502** that move into engagement with the oilfield equipment **104** through a window **504** in the latch housing **200**. The alternative latch members **500** may have several actuators **118** located radially about the latch housing **200**, or there may be annular actuators as described above that engage each of the locking dogs **502**. Any suitable actuator including those described herein may be used. The locking dogs **502** may have one or more biasing members **506** configured to bias the locking dogs **502** toward the disengaged position. The biasing member may be a coiled spring, a leaf spring, an elastomeric member, a fluid bias, and the like. It should be appreciated that the one or more biasing members **506** may be used in conjunction with any of the latch members **116** described herein. Further, the biasing member **506** may be used to bias the alternative latch member **500** toward the engaged position.

An operation of the latch **102** will now be described in conjunction with the Figures. FIG. **3** depicts the latch **102** in the disengaged position. In the disengaged position, the engagement actuator **224** may be against the terminal end of the actuator cavity **222**. The latch member **116** may remain in the disengaged position due to the bias of the latch member **116**. The sensors **119** may indicate that the engagement actuator **224** is in the disengaged position. In the disengaged position, the oilfield equipment **104**, or outer sleeve **208** may optionally be moved into or out of the housing **114**. The latch **102** may remain in the disengaged position until the operator and/or the controller **120** determine the oilfield equipment **104** is in position and needs to be latched.

FIG. **6** depicts the latch **102** in an intermediate position. The fluid pressure has been increased in the fluid chamber **301***a*. The increased fluid pressure moves the engagement actuator **224** into engagement with the engagement edge **325** of the latch member **116**. The steep inclined ramp **328***a* may quickly move the latch member **116** toward the engaged position. The engagement shoulder **304** may engage the nose **306** of the disengagement actuator **226** thereby moving the disengagement actuator **226** clear of the latch member **116**. The sensors **119***a* and **119***b* at the terminal ends of the actuator cavity **222** may indicated that the engagement actuator **224** and the disengagement actuator **226** are not in the contact with the terminal ends. The sensor **119***b* may measure the exact location of the actuators **118**.

FIG. **7** depicts the latch member **116** engaging the outer sleeve **208** and/or the oilfield equipment **104**. The engaging portion **318** may self align the outer sleeve **208** as the latch member **116** continues its radial inward travel. The C-ring **400** may compress the gap **402** (as shown in FIG. **4**). The ramp **302***b* having a smaller incline may be engaged with the engagement ramp **328***b* thereby reducing the radial inward speed of the latch member **116** versus the engagement actuator **224**. The continued linear movement of the engagement actuator **224** will slowly align the outer sleeve **208** and engage the latch member **116**. The sensor **119***b* may continue to track the location of the actuators **118**.

FIG. **8** depicts the latch member **116** in the engaged position. In the engaged position, the engagement actuator **224** has moved latch member **116** radially inward as far as it may travel into engagement with the outer sleeve **208**. As shown, the ramp **302***a* is engaged with the engagement ramp **328***c*, however, it should be appreciated that there may be a gap between these ramps. The disengagement actuator **226** may be engaged with the terminal end of the actuator cavity **222**, or there may be a gap therebetween. The sensor **119***c* may detect the disengagement actuator **226** has reached the terminal end and thereby the engaged position. The sensor **119***b* may continue to track the location of the actuators **118** and thereby the latch member **116**.

FIG. **9** depicts a position wherein the latch member **116** is caught, stuck, held, jammed, wedged, stranded, or so impacted as that it will not spring to the disengaged position, or release position. The disengagement actuator **226** has moved the engagement actuator **224** clear of the latch member **116** with fluid pressure applied from the fluid chamber **301***b*. The latch member **116** however, has not moved, or sprung, to the disengaged position due to being caught, stuck, held, jammed, and/or wedged in the housing **200**. Continued movement of the disengagement actuator **226** directly forces or engages the disengagement ramp **326** with the ramp **302***c* of the disengagement actuator **226**. The ramp **302***c* then positively moves the latch member **116** radially outward toward the disengaged position with continued linear movement of the disengagement actuator **226**. The sensor **119***b* may continue to track the location of the actuators **118** and thereby the latch member **116**.

FIG. **10** depicts the latch member **116** in the disengaged position after the disengagement actuator **226** has positively removed the latch member **116**. In this position, the nose **306** of the disengagement actuator **226** has pushed the engagement shoulder **304** and thereby the engagement actuator **224** to the terminal end of the actuator cavity **222**. The latch member **116** is in the disengaged position and is prevented from moving toward the engaged position by the disengagement ramp **326** and the ramp **302***c*. The sensor **119***a* may determine that the engagement actuator **224** has engaged the terminal end of the actuator cavity **222** and the sensor **119***b* may verify the position of the actuators **118**. The latch **102** may remain in this position while the outer sleeve **208** and/or the oilfield equipment **104** is removed from the housing **114**. The operator and/or the controller **120** may then place another piece of oilfield equipment **104** in the RCD and the latch **102** may be actuated to secure the oilfield equipment **104** with the latch member **116**.

FIG. **11** depicts a cross-sectional top view of the latch **102** having the C-ring **400** latch member **116** in the disengaged position. The oilfield equipment **104** is shown placed in the housing **114** for latching to the latch **102**. A portion of the disengagement actuator **226** is shown surrounding the latch member **116**. The sensor **119***b* monitors the location of the disengagement actuator **226** as it travels in the actuator cavity **222**.

FIG. **12** depicts the cross-sectional top view of the latch **102** as shown in FIG. **11** having the C-ring **400** latch member **116** in the engaged position. As the engagement actuator **224** (shown in FIGS. **2-10**) moves the latch member **116** radially inward, the gap **402** is closed and the oilfield equipment **104** is engaged by the latch **102**. The sensor **119***b* may positively identify that the location of the disengagement actuator **226** and thereby the latch member **116**.

FIGS. **13**A and **13**B represent an alternative embodiment of the latch **102** of FIG. **1**. The latch **102** in this embodiment may have one actuator **118** configured to move the latch member **116** toward the engaged position and toward the disengaged position depending on the direction of travel of the actuator **118**. The sensor **119***b* may determine the position of the actuator **118** as it travels in the actuator cavity **222**. The interaction between the actuator **118**, or piston, and the latch member **116**, or locking dog, may have a dovetail arrangement **1300** (with angled ledges in a slot **1302**) to move the latch member in and out. The actuator **118** and latch member **116** may be annular or there may be several actuators and/or latch members **116** for latching the oilfield equipment **104**.

In another embodiment shown in FIG. **14**, the latch member(s) **116** may be driven by one piston that has a linkage system **600**. Although not limited to, in this embodiment six to eight latch member(s) (locking dogs) **116** may be implemented and staggered circumferentially around the latch housing **200**. The linkage system **600** may push the latch member **116** into the engaged position when the actuator **118** travels in a first direction, and may pull the latch member **116** toward the disengaged position when the actuator **118** travels in the opposite direction. In the embodiment shown, the linkage system **600** includes a link or follower arm **610** with pin connection **604***a* to the latch member **116**. The link **610** has another pin connection **604***b* to an optional roller **606**. The actuator may include a ramp(s) or interface(s) **602** to push the ramp(s) **328**. Optionally, the actuator **118** has a groove **608**. The groove **608** allows for movement of the roller **606** (if included) during operation. The actuator **118** may, for example, be hydraulically or pneumatically actuated. The linkage system **600** converts axial movement of the actuator **118** into radial movement of the latch **116** (e.g. when the actuator **118** is axially moved up in the embodiment shown the link **610** pulls the latch member **116** for retraction of the latch). If the groove **608** is eliminated, both pin connection points **604***a* and **604***b* are fixed and the ramp **602** could be eliminated (in which case the link **610** could actuate to latch and unlatch (i.e. both push and retract the latch member **116**) and, further, in which case the link **610** could optionally be made to include some elasticity such as, for example, in a shock absorbing device).

In other embodiments, the latch member **116** may be radially driven between the engaged and disengaged position using one or more radial rod(s) **700**. The radial rod(s) **700** may be built into the housing **114**, or may protrude from the housing **114** in order to motivate the latch member **116**. Although not limited to, in this embodiment six to eight latch member(s) (locking dogs) **116** may be implemented and staggered circumferentially around the latch housing **200**. In the embodiment shown in FIGS. **15-16**, the end **704** or the rod **700** is attached to the latch member **116** and the end **706** protrudes from the housing **114**. A cap **708** is secured over the end **706** with a spring **710** mounted around the rod **700** between the cap **708** and the housing **114**. The actuator **118** has a slot **712** to accommodate the rod **700** as the actuator **118** moves axially between housing **200** and housing **114**. A seal or packing gland **714** is placed around the rod **700** in the channel **716** through the housing **114**. The rod **700** may be biased (i.e. by the spring **710**) to either retract or to engage via the latch member **116**. The actuator **118** may, for example, be hydraulically or pneumatically actuated. The actuator **118** functions as a first actuator (piston) which moves the latch member **116** inward into the "latched" position via interaction of the ramp(s) or interface(s) **328** and **702**. Next, as the actuator **118** is moved axially upward in the figure, the actuator **118** via or because of the slot **712** moves independently of (merely moves without direct causal effect on) the latch member **116**. Then the biased rod **700** functions as a second actuator to physically move the latch member **116** to the retracted position. One variant for this embodiment is that the travel of the rod **700** projecting through the housing **114** can be directly detected by a sensing means **119***d* (i.e. detected by a sensor measuring position or distance, and/or visually inspected) in order to provide an indication of the travel or position of the latch member **116** (therefore, the position and/or travel of the latch member **116** is directly detected, i.e. not inferred via monitoring flow of a hydraulic fluid, etc.). Additionally, should the latch member **116** not retract fully, it would be possible to pull on the rod **700** in order to move the rod **700**. The pull may be achieved by actuating an additional mechanical or hydraulic tool, e.g. piston (not shown), located on the outside of the housing **114**, or may be performed manually by an operator. In another variation, the rod **700** may be actuated by a second actuator similar to disengagement actuator **226** (shown in FIG. **6**) instead of by the spring **710**. In another variation, the latch member **116** may be both latched and retracted by actuation of the rod **700** via a piston (radially) mounted exterior of the housing **114**.

In the embodiment shown in FIGS. **17** and **18**, the radial rod(s) **700** are shown built and fully contained within the housing **114**. The end **704** or the rod **700** is attached to the latch member **116**, and the end **706***a* is contained within from the housing **114**. A carriage head **708** is secured or formed at the end **706***a* with a spring **710** mounted around the rod **700** between the carriage head **708** and the housing **114**. The actuator **118** has a T-slot **712***a* including an angled ledge **718** to accommodate the carriage head **708** and rod **700** as the actuator **118** moves axially between housing **200** and housing **114**. A sliding base (such as for example a washer) **720** may be placed around the rod **700** as part of the carriage head **708** and rides on the angled ledge **718**. The rod **700** is biased (i.e. by the spring **710**) to retract the latch member **116**. The actuator **118** may, for example, be hydraulically or pneumatically actuated. The actuator **118** functions as a first actuator (piston) which moves the latch member **116** inward into the "latched" position (FIG. **17**) via interaction of the ramp(s) or interface(s) **328** and **702**. Next as the actuator **118** is moved axially upward in the figures, the actuator **118** via T-slot **712***a* merely moves without direct causal effect on the latch member **116**. Then the biased rod **700** (via interaction between the carriage head **708**, the angled ledge **718**, the sliding base **720** and the spring **710**) functions as a second actuator to physically move the latch member **116** to the retracted position. This embodiment alleviates the need to provide a seal **714** (FIGS. **15-16**) between the housing **114** and the rod **700**.

The embodiment shown in FIGS. **19** and **20** are similar to the embodiments shown in FIG. **13**A except the dovetail arrangement **1300** is replaced by a rod **700** which rides in a T-slot or groove **608**. The rod **700** may be configured as a carriage head **708***a* (such as for example in the form of a "T" shaped member or as a claw, and/or may be connected to a roller **606**). Although not limited to, in this embodiment six to eight latch member(s) (locking dogs) **116** may be implemented and staggered circumferentially around the latch housing **200**. The embodiment of FIGS. **19** and **20** converts axial movement of the actuator **118** into radial movement of the latch members **116** to both engage and retract the latch members **116**.

The embodiment shown in FIGS. **21** and **22** is similar in form and function to the embodiment shown in FIGS. **3** and **6**. An engagement actuator **224** and disengagement actuator **226** are shown. Engagement ramp(s) **328***a, b* & *c* along with ramp/interface(s) **302***a* & *b* are shown. The disengagement actuator **226** includes ramp/interface **302***c* whilst the latch member **116** includes disengagement ramp/interface **326**.

In the embodiment shown in FIG. **23** the latch member **116** may be radially driven between the engaged and disengaged position using one or more piston(s)/actuators **800**. Each piston(s) **800** forms a unitary piston having combined or integrated a piston head **804** together with a rod/latch member **116**. The unitary piston **800** may be mounted into a radial bore **806** in the housing **114** in order to motivate the latch member **116**. Although not limited to, in this embodiment four to eight latch member(s) (locking dogs) **116** may be implemented and staggered circumferentially around the latch housing **200**. A spring **810** (optionally together with wellbore pressure) may function as a second actuator to bias the latch member **116** to the unlatched position. Hydraulic or pneumatic pressure may be communicated to the bore **812** and sufficient pressure will overcome the force of the spring **810** (together with wellbore pressure) to force the piston **800** and therefore the latch member **116** into the latched position. As suggested, the latch member **116** is released by relieving the hydraulic or pneumatic pressure in the bore **812** until the force of the spring **810** (together with wellbore pressure, if any) retracts the latch member **116** to release the item of oilfield equipment **104**. A seal **814** (e.g. an o-ring) may be mounted around the piston **800** to seal the actuator cavity **222**. The base **116***a* of the latch member **116** is preferably rectangular.

In the embodiment shown in FIG. **24**, spring(s) **900** (such as, e.g., leaf spring arm(s)) are shown built and fully contained within the housing **200** and latch member(s) **116** in respective leaf spring pockets **902** and **904**. Note that a shoulder **906** built into the latch member(s) defines the leaf spring pocket **904** in the latch member(s) **116**. This embodiment could include multiple individual leaf spring arm(s) **900** or the leaf spring arm(s) **900** could be milled (e.g. five to sixteen leaf spring arm(s)) could be milled into a unitary annular leaf spring device). The latch member **116** is biased (i.e. by the spring(s) **900**) to retract the latch member **116**. The actuator **118** may, for example, be hydraulically or pneumatically actuated. The actuator **118** functions as a first actuator (piston) which moves the latch member **116** inward into the "latched" position (as represented in FIG. **24**) via interaction of the ramp(s) or interface(s) **328** and **302**. Next, as the actuator **118** is moved axially upward in the figure, the force of the actuator **118** is removed from outer circumference of the latch member **116**. Then, the biased spring(s) **900** (via interaction between the respective leaf spring pockets **902** and **904** as they correspond to housing **200** and latch member **116**, and more specifically by forcing shoulder **906** of latch member **116** relative to housing **200**) function as a second actuator to physically move the latch member **116** to the retracted position.

For each embodiment represented those having ordinary skill in the art may devise systems to fulfill various options, including, that the actuator **118** may be biased to an engaged position; the actuator may be biased to a disengaged position; the latch member(s) **116** may be biased to the latched position; and/or the latch member(s) **116** may be biased to the unlatched position.

The disclosure of U.S. patent application Ser. No. 12/643,093, published as US2010/0175882 is hereby incorporated by reference (see, e.g., FIG. **6**A of that disclosure) for purposes of teaching and disclosing that three (for example) latch members in parallel could be implemented into a combination latching system.

FIG. **25** depicts a flow chart depicting a method of using the latch **102**. The flow chart begins at block **1402** wherein an item of oilfield equipment **104** is installed into a housing. The flow chart continues at block **1404** wherein a first force is applied to an actuator **118** to move the actuator **118**. The flow chart continues at block **1406** wherein the first force is transferred from the actuator **118** to a latch member **116**. The flow chart continues at block **1408** wherein the latch member **116** is moved to a radial engaged position in which it is engaged with the item of oilfield equipment **104**. The flow chart continues at block **1409** wherein it is determined if the position of the actuator is to be monitored. If the actuator position is to be monitored, the flow chart continues with the optional step shown at block **1410** wherein the position of the actuator **118** is monitored while the actuator moves. The position may be monitored during the movement of the latch radially inward and/or radially outward. The flow chart continues with the optional step shown at block **1412** wherein the position of the latch member **116** is determined from the position of the actuator **118**. Regardless of whether or not the actuator position is to be monitored, the flow chart may continue at block **1414** wherein a second force is applied to the actuator **118** to move the actuator. The flow chart continues at block **1416** wherein the second force is transferred from the actuator **118** to the latch member **116**. The flow chart continues at block **1418** wherein the latch member **118** is moved radially and disengaged from the item of oilfield equipment **104**. Optionally during use of the latch **102**, the controller **120** may prevent removal of the oilfield equipment while the latch member **118** is engaged with the item of oilfield equipment **104**. The controller may actively prevent the removal of the oilfield equipment **104** thereby preventing inadvertent damage to the latch **102** and/or the oilfield equipment (for example, the controller may control a secondary drilling system for example by preventing the choke from being closed).

FIG. **26** shows another embodiment of a latch **102** in which the actuator or actuators **118** causes the latch member **116** to move outward to engage the item of oilfield equipment **104** to be engaged, and to move inward to retract the latch member **116**. The above more specific embodiments for engaging and retracting may be implemented to achieve this more schematic embodiment. In the schematic embodiment of FIG. **26**, the latch member **116** and actuator(s) **118** are mounted to an inner item of oilfield equipage **127** for selectively engaging an outer item of oilfield equipment **104**.

While the embodiments are described with reference to various implementations and exploitations, it will be understood that these embodiments are illustrative and that the scope of the inventive subject matter is not limited to them. Many variations, modifications, additions and improvements are possible. For example, the implementations and techniques used herein may be applied to any latch member at the wellsite, such as the BOP and the like.

Plural instances may be provided for components, operations or structures described herein as a single instance. In general, structures and functionality presented as separate components in the exemplary configurations may be implemented as a combined structure or component. Similarly, structures and functionality presented as a single component may be implemented as separate components. These and other variations, modifications, additions, and improvements may fall within the scope of the inventive subject matter.

What is claimed is:

1. An apparatus for latching an item of oilfield equipment comprising:

- a housing;
- a latch member contained within the housing, the latch member movable between a radially engaged position in which it is engaged with the item of oilfield equipment, and a radially retracted position in which it is disengaged from the item of oilfield equipment;
- a first actuator configured to drive the latch member into the radially engaged position; and
- a second actuator configured to positively force the latch member into the radially retracted position;
- wherein the housing defines a slot, wherein the slot is defined in a position selected from the group consisting of above the latch member, below the latch member, and above and below the latch member, wherein the slot is configured to relieve an amount of debris or a volume of fluid or both.

2. The apparatus of claim **1**, wherein the first actuator and the second actuator are connected together.

3. The apparatus of claim **1**, wherein movement of one of the first actuator and the second actuator causes movement of the other of the first actuator and the second actuator.

4. The apparatus of claim **1**, wherein the latch member is biased to a position corresponding to the radially engaged position of the latch member.

5. The apparatus of claim **1**, wherein the latch member is biased to a position corresponding to the radially retracted position of the latch member.

6. The apparatus of claim **1**, wherein the first actuator is driven by the application of hydraulic pressure.

7. The apparatus of claim **1**, wherein the second actuator is positively forced by the application of hydraulic pressure.

8. The apparatus of claim **1**, further comprising at least one sensor for monitoring the position of at least one of the first actuator and the second actuator and thereby determining the position of the latch member.

9. The apparatus of claim **8**, further comprising a flow rate meter including a means for determining the position of the actuator and thereby the latch member.

10. The apparatus of claim **8**, further comprising at least one controller configured for controlling the first actuator.

11. The apparatus of claim **10**, wherein the at least one controller is further configured for controlling the second actuator.

12. The apparatus of claim **1**, wherein the second actuator comprises a link pinned to the latch member at one end and pinned to the first actuator at another end; and wherein the latch member is positively forced into the radially retracted position by pull of the first actuator on the link and by pull from the link on the latch member.

13. The apparatus of claim **1**, wherein the second actuator comprises a radial rod attached at one end to the latch member, and a spring biased between the housing and a cap located at the other end of the radial rod;

- wherein the latch member is driven into the radially engaged position by engagement at a first contiguous interface between the first actuator and the latch member; and wherein the latch member is positively forced into the radially retracted position by the spring biasing the radial rod and the latch member away from the housing.

14. The apparatus of claim **13**, wherein the housing has a channel;

- wherein the radial rod passes through the channel and protrudes from the housing; and wherein a seal is mounted in the channel between the housing and the radial rod.

15. The apparatus of claim **14**, further including a means for directly sensing the position of the radial rod mounted on the housing.

16. The apparatus of claim **1**, wherein the first actuator has a ledge within another slot defined radially through the first actuator; wherein the second actuator comprises a radial rod attached at one end to the latch member, and a carriage head located at the other end of the radial rod; wherein the latch member is driven into the radially engaged position by engagement at a first contiguous interface between the first actuator and the latch member; and wherein the latch member is positively forced into the radially retracted position by the carriage head riding on the ledge as the first actuator is driven in an axial direction.

17. The apparatus of claim **1**, wherein the first actuator has a ledge within another slot defined in the first actuator; wherein the second actuator comprises a dovetail arrangement located at one end to the latch member; wherein the latch member is driven into the radially engaged position by engagement at a first contiguous interface between the first actuator and the latch member; and wherein the latch member is positively forced into the radially retracted position by the dovetail arrangement riding on the ledge as the first actuator is driven in an axial direction.

18. The apparatus of claim **1**, wherein the latch member and the first actuator together form a unitary piston; wherein the unitary piston has a piston head; wherein the housing defines a radial bore; and wherein the second actuator comprises a spring mounted in the radial bore between the piston head and the housing.

19. The apparatus of claim **1**, wherein the latch member has a shoulder; wherein the second actuator comprises a leaf spring arm biased between the housing and the shoulder; wherein the latch member is driven into the radially engaged position by engagement at a first contiguous interface between the first actuator and the latch member; and wherein the latch member is positively forced into the radially retracted position by the leaf spring arm biasing the shoulder and the latch member away from the housing.

20. The apparatus of claim **1**, wherein the radially engaged position is an inward position and wherein the radially retracted position is an outward position.

21. The apparatus of claim **1**, wherein the radially engaged position is an outward position and wherein the radially retracted position is an inward position.

22. The apparatus of claim **1**, wherein the housing further defines an annular slot configured to relieve an amount of pressure and an amount of debris.

23. The apparatus of claim **1**, wherein the housing further defines an annular slot configured to relieve a volume of fluid.

24. The apparatus of claim **1**,

wherein the latch member is driven into the radially engaged position by engagement at a first contiguous interface between the first actuator and the latch member;

wherein the latch member is positively forced into the radially retracted position by engagement at a second contiguous interface between the second actuator and the latch member;

wherein the first contiguous interface includes a first engagement ramp and a second engagement ramp on the latch member;

wherein the latch member further includes a third engagement ramp; and

wherein the latch member is held in the radially engaged position by a keeper position via engagement at a third contiguous interface between the first actuator and said third engagement ramp.

25. The apparatus of claim **1**,

wherein the latch member is driven into the radially engaged position by engagement at a first contiguous interface between the first actuator and the latch member with the engagement occurring in a first axial direction;

wherein the latch member is positively forced into the radially retracted position by another engagement at a second contiguous interface between the second actuator and the latch member with the other engagement occurring in a second axial direction; and

wherein the latch member is held in the radially engaged position by a keeper position via engagement at a third contiguous interface between the first actuator and the latch member with the engagement occurring in the first axial direction.

26. An apparatus for latching an item of oilfield equipment comprising:

a housing;

a latch member contained within the housing, the latch member movable between a radially engaged position in which it is engaged with the item of oilfield equipment, and a radially retracted position in which it is disengaged from the item of oilfield equipment;

a first actuator configured to drive the latch member into the radially engaged position; and

a second actuator configured to positively force the latch member into the radially retracted position;

wherein the latch member is a C-ring latch member, wherein the C-ring latch member is constructed of an energizable spring material, and wherein the C-ring latch member defines a gap wherein the gap is configured to be collapsible.

27. The apparatus of claim **26**, wherein the C-ring latch member is biased toward the radially retracted position.

28. The apparatus of claim **26**, wherein the C-ring latch member is biased toward the radially engaged position.

29. The apparatus of claim **26**, wherein the C-ring latch member defines a slot configured to relieve an amount of debris.

30. The apparatus of claim **29**, wherein the housing defines a slot below the C-ring latch member configured to relieve an amount of debris.

31. The apparatus of claim **26**, wherein the C-ring latch member defines a slot configured to relieve a volume of fluid.

32. The apparatus of claim **31**, wherein the housing defines a slot below the C-ring latch member configured to relieve a volume of fluid.

33. An apparatus for latching an item of oilfield equipment comprising:

a housing;

a latch member contained within the housing, the latch member movable between a radially engaged position in which it is engaged with the item of oilfield equipment, and a radially retracted position in which it is disengaged from the item of oilfield equipment;

an actuator configured to drive the latch member into the radially engaged position;

wherein the actuator is configured to positively force the latch member toward the radially retracted position, and

wherein the actuator comprises:

an engagement actuator wherein the engagement actuator includes an engaging ramp; and

a disengagement actuator wherein the disengagement actuator includes a disengaging ramp;

wherein the latch member has an engagement edge interposed between the engagement actuator and the disengagement actuator for moving the latch member to the radially engaged position via the engaging ramp and for positively forcing the latch member to the radially retracted position via the disengaging ramp;

wherein the engagement edge of the latch member comprises a first engagement ramp, a second engagement ramp, and a third engagement ramp;

wherein said first engagement ramp and said second engagement ramp are configured for moving the latch member to the radially engaged position; and

wherein said third engagement ramp is configured to maintain the latch member in a keeper position when the latch member is in the radially engaged position.

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